American Foundryman

THE FOUNDRYMEN'S OWN MAGAZINE

APRIL 1950

PRE-CONVENTION ISSUE

The furnace that
WOULDN'T COMPROMISE

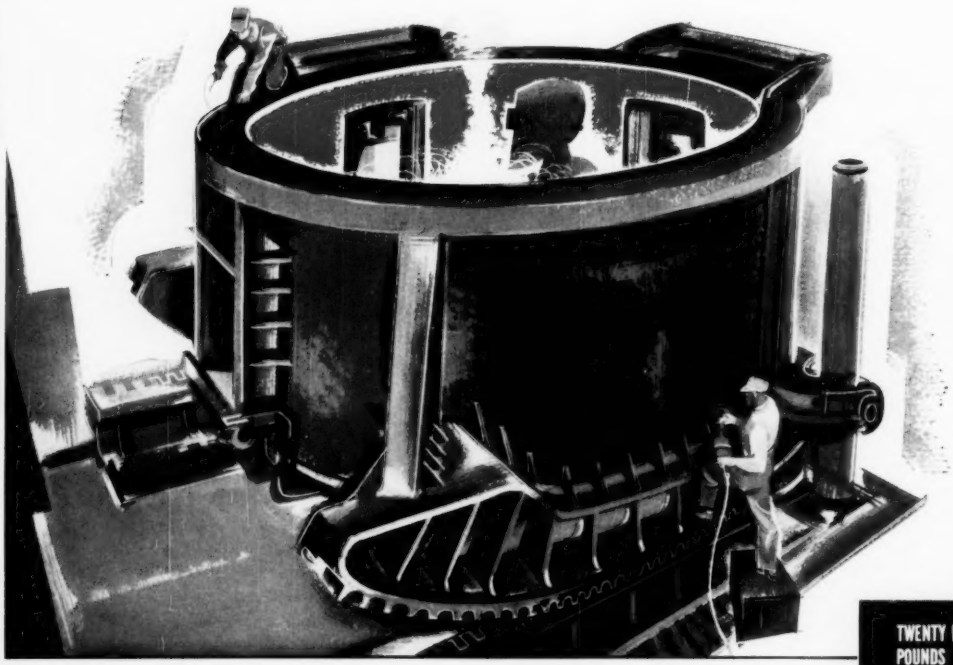
Burdens imposed on an electric arc furnace probe the soundness of every member. Electric currents thunder along near short-circuit levels, temperatures are terrific, physical loads way above rated figures. Lectromelt Furnaces and their auxiliary equipment have proved themselves in that kind of service.

Some years ago, when buyers were asking "How much?" before "How good?", Lectromelt set out to build a competitive model. Construction was to be lightened up generally. But as Moore, inventor of the Rapid Lectromelt Furnace, watched it grow, he wasn't happy. The furnace wasn't Lectromelt.

The "competitive model" was never built. The finished furnace had all the refinements developed by Lectromelt throughout the years. The wisdom of this thinking is reflected in these facts: Lectromelt Furnace users buy mighty few replacement parts. Furnaces installed many years ago are still going strong.

Refusal to compromise is an important point to look for when considering an electric furnace. For helpful data, write for Bulletin No. 7. Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . SWEDEN: Birlec Elektkougnar A B, Stockholm . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilboa . . . ITALY: Forni Stein, Genoa.



WHEN YOU MELT... MOORE RAPID *Lectromelt*

A good performer *deserves* an encore.....

SEE YOU AT THE SHOW
Booths 1112 and 1116

and this explains the repeat orders for Federal

GREEN BOND

BEST OF THE WYOMING BENTONITES

THE FEDERAL FOUNDRY SUPPLY COMPANY

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CROWN HILL, W. VA. • CHICAGO • CHATTANOOGA, TENN. • DETROIT • MILWAUKEE • NEW YORK • ST. LOUIS • RICHMOND, VA. • UPTON, WYO.

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WHY *PROGRESSIVE* FOUNDRIES RELY ON...

for Better Castings

A modern cupola, holding ladle and electric bull ladle installation in Meadow Lands, Pa., plant of American Brake Shoe Co.

Purite is widely accepted as the most economical desulphurizer and cupola flux by progressive foundry operators everywhere. And here are seven good reasons why:

1. **Purite gives 100% fluxing action in the cupola — 100% desulphurizing action in the ladle.**
2. **Purite gets to the iron quicker — no faster desulphurizer made.**
3. **Purite is time-tested and proven for unsurpassed desulphurizing uniformity.**
4. **Purite comes in 2-lb. pigs — no weighing or measuring required.**
5. **Purite is 100% fused soda ash — you do not pay for inert materials.**
6. **Purite does not crumble — no waste — no dust.**
7. **Purite can be shipped in bulk carloads at substantial savings over bag shipments — is easily stored without deterioration.**

These everyday benefits show why Purite enjoys such widespread use as the foremost cupola flux and ladle desulphurizing agent. For full information, write today for literature telling how you can improve your iron with Purite. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

PURITE
100% FUSED SODA ASH
The Scientific Flux for Better Melting and Cleaner Iron

Purite is sold by all leading foundry supply houses in the United States and Canada.

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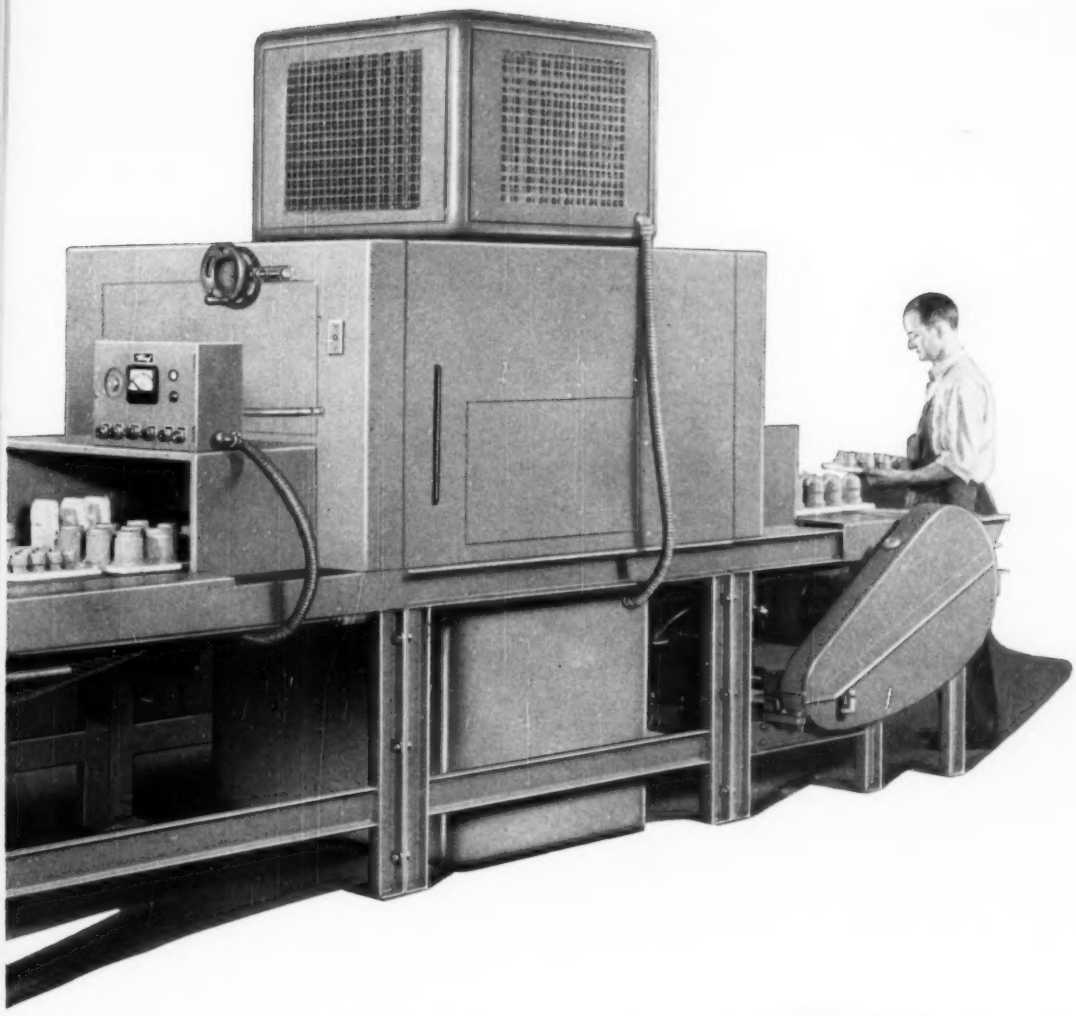
Introducing the sensational
NEW "DRI-BOX"

Blow-in Type Combination Core Box and Drier Precision-Made of Durable Plastic

at the Foundry Show Booth 1317

THE GIRDLER CORPORATION • Thermex Division • Louisville 1, Kentucky



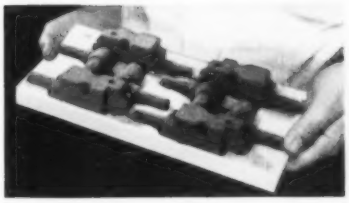
YOU'LL GET a good idea for really *cutting costs* when you visit us at the Foundry Show!

You'll see the new, compact, conveyorized THERMEX High Frequency Core Baking Apparatus on the job in our booth . . . baking cores in minutes on a continuous basis. You'll see how it can increase coreroom yields from 60% to more than 90% . . . how it cuts the number of driers needed . . . how it simplifies flow of production and operations all down the line. And you'll see how Thermex high frequency heating, by baking cores from within, produces *better cores* . . . no burned or broken surfaces . . . fewer casting rejects.

If you can't come to the Show, write for complete details on the new THERMEX High Frequency Core Baking Apparatus!

See how *Thermex* can cut your costs!

- **Simple to install.**
- **Uses synthetic resin binders. Cuts mulling time.**
- **Cuts trucking and racking time.**
- **Baking takes only 20 seconds to 2 or 3 minutes.**
- **Uses power only during actual baking.**
- **Requires fraction of usual number of driers.**
- **Produces perfect cores . . . cuts casting cleaning time.**
- **Minimizes rejects of cores and castings.**
- **Cuts core-baking maintenance costs.**



See the new "Dri-Box" too!

Developed by Thermex engineers, the "Dri-Box" is a blow-in type combination core box base and core drier. Precision-built of tough, durable, lightweight plastic, it does not stick to cores . . . remains free of carbon deposits. Virtually eliminates core breakage. Doubles core-making output. See it at the Show or write for details.

For faster baking time

use CYCOR*151 synthetic resin binder for sand cores and dry molds

Cycor 151 gives foundries 33% to 50% faster baking time than old-time binders—at baking temperatures of only 350°F. This means positive savings in production and BTUs.

The use of Cycor 151 improved synthetic resin binder for sand cores and dry molds also means many other advantages in the production of cleaner, more uniform castings. Good collapsibility. Elimination of expensive clean out.

And don't forget this: with Cycor 151, you purchase *only* the neat synthetic resin; you can modify this resin with fillers or extenders to meet your particular requirements.

Get the particulars about Cycor 151 for use in your own foundry. Just write to Plastics Department, American Cyanamid Company, 30-36 Rockefeller Plaza, New York 20, N. Y.

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APEX

Z-50

ALUMINUM

ALLOY

Your production line is your profit line—safeguard it by using APEX Z-50, a proven quality alloy. Having uniform casting characteristics with better-than-average mechanical properties, *and free machinability*, APEX Z-50 will meet most of your casting requirements. When quality plus economy is paramount, specify APEX Z-50—"Proved Best By Test"!

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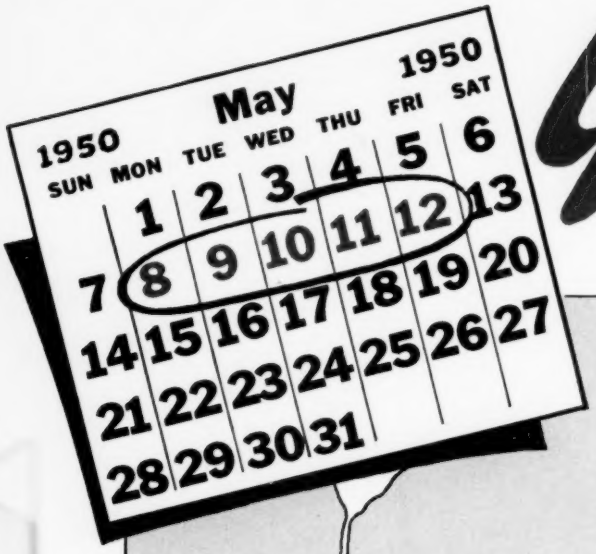
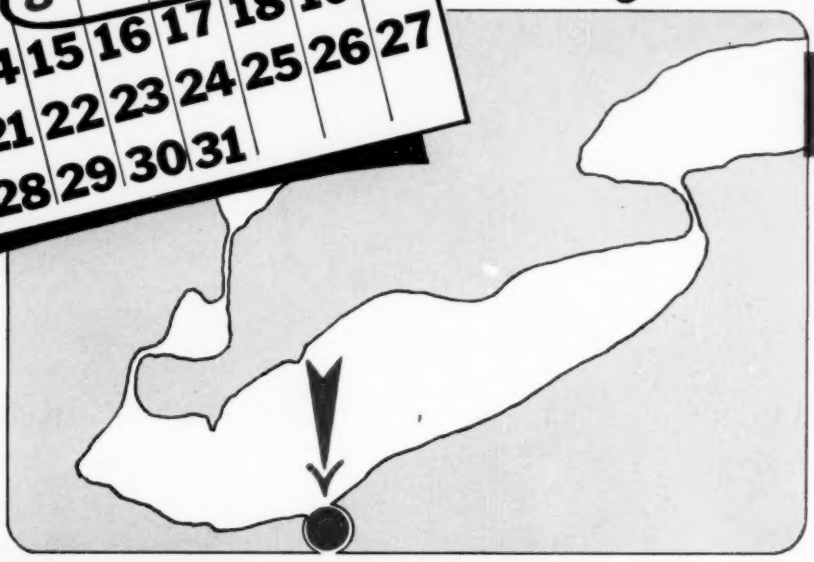


You're ... for this



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The "home town" of

Famous

CORNELL FLUX

The time-proven molten metal cleanser

in Our Plans

important foundry date!

VISIT BOOTH 119-121 FOUNDRY SHOW

We are anxious to show our appreciation to old customers, and show others why Famous Cornell Molten Metal Flux is used by leading foundries, so that they will go back home with information that leads to better castings, reduced rejects, better deliveries and increased profit.

Famous CORNELL CUPOLA FLUX
(IN SCORED BRICK FORM)

This dependable metal cleanser is widely endorsed as invaluable to good casting production.

- It removes impurities from molten iron, and makes it hotter and more fluid.
- It reduces sulphur and makes slag more fluid.
- It reduces rejects because castings are sounder, tougher and cleaner. Chilled sides, hollow centers, hard spots, etc. are greatly reduced.
- It makes machining easier, faster, smoother.
- It reduces cupola maintenance. Drops are cleaner, there is less bridging over, and the glazed or vitrified surface which is formed over brick or stone lining, reduces erosion and repairs.

OUTSTANDING MALLEABLE FOUNDRIES ARE REGULAR USERS, TOO. Wherever there is cupola operation, Famous Cornell Cupola Flux gives castings a better start.

Write for Bulletin No. 46-B

SCORED BRICK FORM saves time, labor in fluxing iron

No digging out of container. No weighing. No measuring.

You simply lift this flux out of container and toss it into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

ALUMINUM FLUX

Cleanses molten aluminum so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Working conditions are improved due to Exclusive Formula which greatly reduces obnoxious gases. The dross does not contain any metal after this flux is used.

•

BRASS FLUX

Cleanses molten brass even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

FAMOUS CORNELL FLUXES
Trade Mark Registered

The CLEVELAND FLUX Company

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Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

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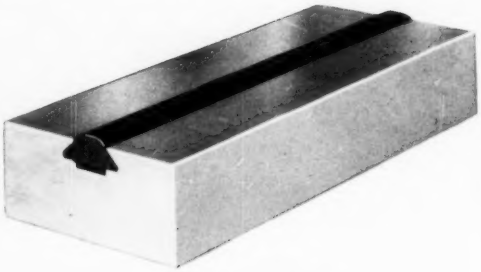
"PROTEXABOX" PINS

Will not loosen — cannot mar box face. Protective rubber tip guaranteed to stay on.



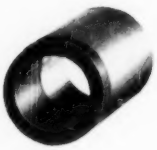
STRIP INSERT

Protects parting line — easily installed in old or new boxes. Eliminates steel facing.

NOW! NEW! Cutters for groove available at moderate cost.

"HOLINER" BUSHINGS

Stop abrasion between blow plate and core box. Protect blow holes.



"SAND ARRESTER TUBES"

Perfect cores every time! Guaranteed for 100,000 blows!

"PULLINSERT" BLOW BUTTONS

Available in nine popular sizes — positively stop sand blasting under blow holes.

"VIBROLATOR"

Draw cores without damage. Guaranteed to feed sand from any hopper.

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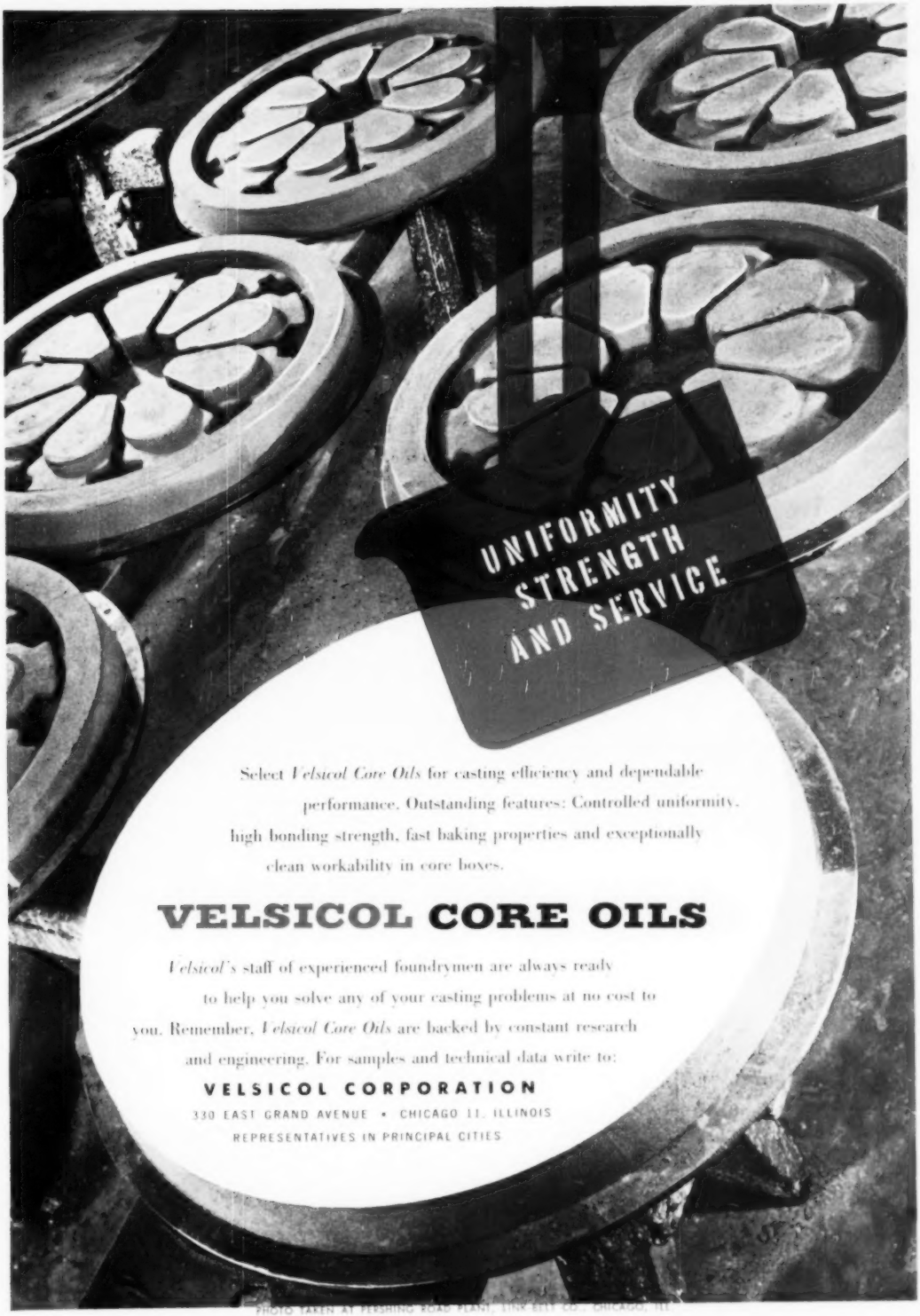
YOUR JOBBER WILL BE HAPPY TO SHOW YOU ANY OF THESE MONEY-SAVING PRODUCTS.

SEE US AT THE SHOW!

Martin Engineering Company will have Booth No. 1004 at the Foundry Show.

MARTIN ENGINEERING COMPANY

KEWANEE 1, ILLINOIS



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PENOLYN CORE OIL!"

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...r maximum foundry efficiency —
...oxious odor • No seepage • No
...de temperature baking range •
Ample collapsibility

...gineers are always ready to help you. Write us about your core oil problem.

PENOLA INC.

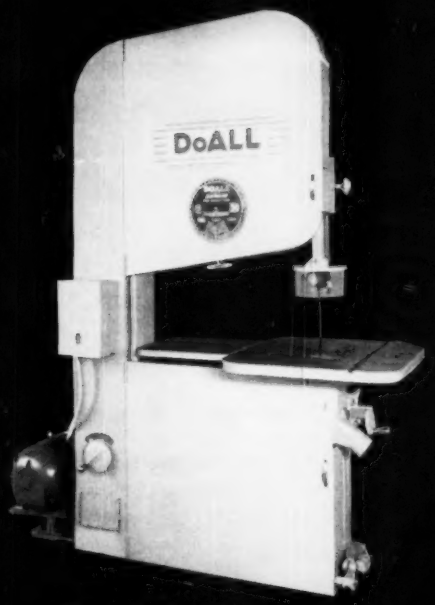
NEW YORK CHICAGO DETROIT ST. LOUIS

Penola

Efficiency of . . .
Continuous BAND CUTTING
Now Extended to the CUTTING of ALL SOLID MATERIALS

New DoALL Band Machines and cutting tools for 1950 give up to 200% faster production cutting and up to 100% longer tool life in the trimming and cutting of ferrous and non-ferrous castings. Tough alloys that have defied economical cutting are now profitably sliced apart with ease on DoALL Band Machines and cutting tools.

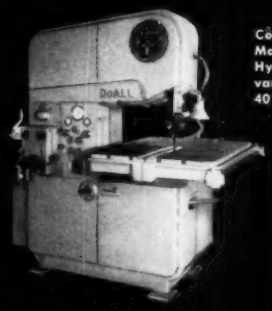
Only DoALL gives you a range of sizes, kinds and operating speeds that are tailored to your specific needs.



Super Zephyr — High Speed and Friction Sawing Machine with 36" capacity — 21 models tailored to your needs in speed range.

Low-Cost Utility DoALLs — 5 models — various speeds — 16" capacity.

Contour Machines—5 models — 16" to 60" capacity — variable speeds.



Contour-matic—the first Band Machine Tool with complete Hydraulic Operation and variable speed range from 40 to 10,000 F.P.M.

SEE DEMONSTRATIONS at FOUNDRY CONVENTION
Cleveland, May 8–12

These latest Foundry and Pattern Shop Machine Tools will be in operation cutting all kinds of castings, patterns, etc. demonstrating:

Friction Sawing **Contour Sawing**
Line Grinding **High Speed Sawing**

DoALL Exhibit No. 1200

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for

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FREE DEMONSTRATIONS IN YOUR PLANT
No obligation, of course.

York Corporation
No. 172 Mexican
for finer finish
The York Corporation, manufacturer of refrigeration and air conditioning units, and operator of large iron foundries, is a regular user of No. 172 Mexican Blacking to produce castings with a *better finish and reduce foundry production costs.* No. 172 is a high quality wet blacking, containing a binder, that can easily be applied to cores and dry sand molds with spray, brush, or swab. It permits the sand to peel freely, leaving a smooth-surfaced casting *that requires minimum cleaning.* No. 172 Mexican Blacking is recommended for medium, extra large and pressure castings weighing 1 to 25 tons. No. 172 is also an excellent core coating. Only water is required to prepare for use. Other Mexican Graphite products include Cordip —for dipping or spraying dry or green sand cores— and Mexacote—for cores and molds in light and medium production casting where extra resistance to high temperature metal is demanded.
THE UNITED STATES GRAPHITE COMPANY

uses Blacking on castings

Three stages of mold preparation at the York Corporation with No. 172 Mexican Blacking. (1)—Mold being sprayed with No. 172. (2)—Mold ready for drying after spraying. (3)—Sprayed mold torch dried and ready for casting.

A typical casting produced with U. S. Graphite No. 172 Mexican Blacking at the York Corporation. Note the fine finish and overall clean appearance of the casting.

We'll see you at the Foundrymen's Convention— Booth 902 in the Arcade

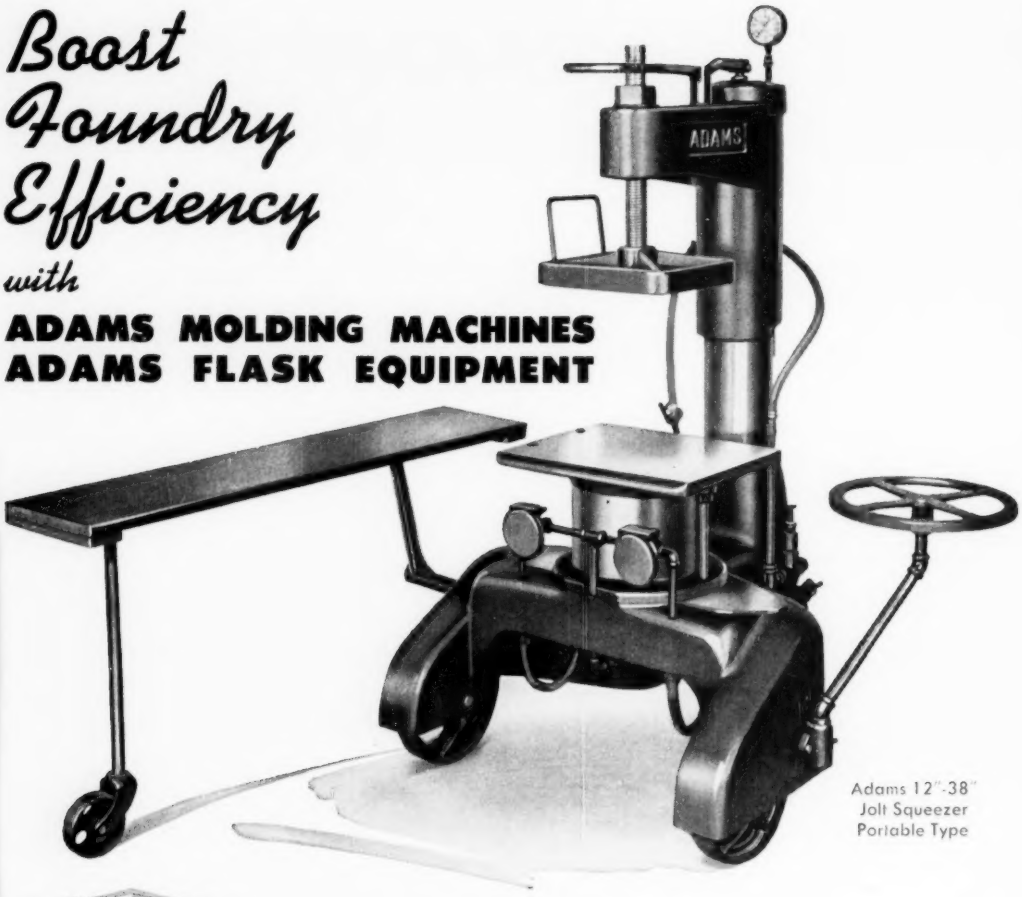
No. 172 Mexican Blacking

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

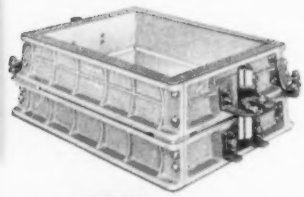
Boost Foundry Efficiency

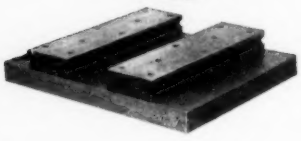
with

ADAMS MOLDING MACHINES
ADAMS FLASK EQUIPMENT



Adams 12"-38"
Jolt Squeezer
Portable Type





SIXTY-SIX YEARS of supplying foundries has given Adams experience and skill in designing machines and equipment that help boost efficiency in your foundry. Call on Adams for quality Flask Equipment, custom-built to your specifications. The complete line includes practically every type of flask, jacket, upset, presser board, bottom plate and band. Adams time and money saving Molding Machines are available in pneumatically operated post and side rod types, in portable and stationary models, also hand operated models.

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Manufactured by

The Adams Company

Dubuque, Iowa, U. S. A.

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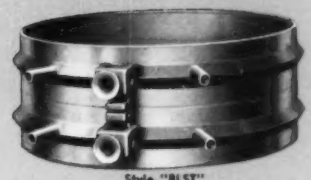
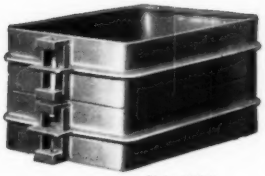
The Spotlight is Focused on the Dependable Line of

Sterling FOUNDRY FLASKS

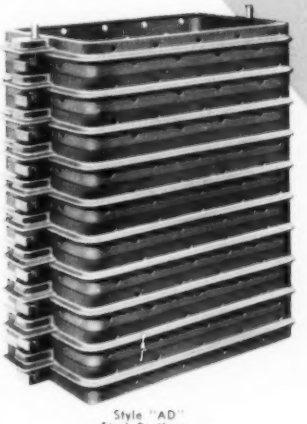
Style "GSX"
with Single Pin Lugs and
Two-Man Lift Handles



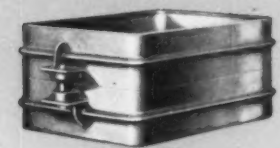
**Style "BLST"
with Trunnions and
Two-Man Lift Handles**



Style "AD"
with Double Pin Lugs

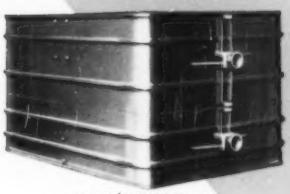


Style "AD"
Flask Sections
Stacked One Above Another
for Multiple Molding

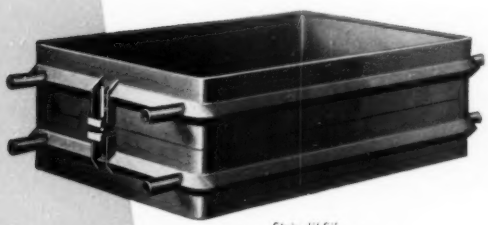


**Style "E"
with Pin Lugs and
Handles Combined**

Style "H"
with Pin Lugs
Welded on Sides



Style "⅛ND-RT Cope"
Style "⅛NS-RT Drag"
Heavy Duty Flask
(Patent No. 1974292)



Style "LS"
with Angle Reinforcement
and Two-Man Lift Handles

Style
"⅛ND-RTX Cope"
"⅛NS-RT Drag"
with Heavy Duty Clamps
(Patent No. 1974292)

North American foundries . . . more than 4,500 of them . . . have adopted Sterling Steel Flasks for greater efficiency, longer life and more profitable foundry operation. These same foundries continue to specify Sterlings whenever more flasks are needed. That's because Sterlings have the strength and rigidity to resist distortion and to take hard, everyday punishment. Fabricated from special rolled steel channel into one solid, rigid piece, Sterling Flasks are capable of withstanding tremendous pressures. They retain their rigidity and accuracy over a long period of years. Available in a variety of styles and shapes. Write for your copy of Sterling Catalog No. 60.

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BOOTH NO. 912
AT THE SHOW**

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U. S. A.

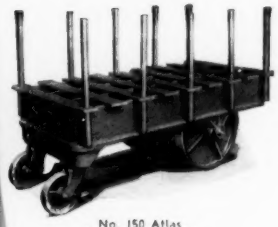
***Branch Offices:* Boston · Buffalo · Chattanooga · Chicago · Cleveland · Detroit · New York · Philadelphia · St. Louis**

The Spotlight is Focused on the Dependable Line of Sterling Foundry Equipment

No. 116-A Heavy Duty Wheelbarrow

No. 50 Slag Buggy

No. 118-A Core Truck

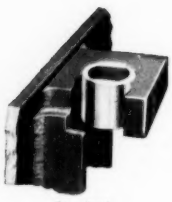


No. 150 Atlas Heavy Duty Truck

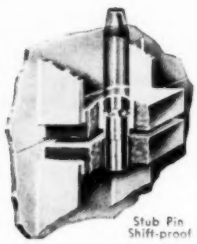
No. 160 Heavy Duty Casting Truck

No. S-5W Wheelbarrow for sand and other dry materials

Heavy Duty Cart with "3-Point" Landing



Standard Hardened Steel Bushing



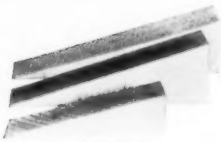
Stub Pin Shift-proof

No. 47 Casting Cart

Style X Core Plate

Sterling Flask Clamp

Standard Type "S" Flask Pin



Hardwood Foundry Wedges

In addition to Steel Flasks, Sterling offers a complete line of Flask accessories and a variety of foundry equipment. Custom-built for heavy duty foundry service and high-speed production schedules, every piece of equipment is backed by the well-known Sterling reputation for correct design and excellent workmanship. The Company has always maintained a policy of fabricating to high quality standards. Consult Sterling the next time you require foundry equipment. The Sterling branch office near you will gladly give you information and estimates — or write to factory.

VISIT STERLING BOOTH NO. 912 AT THE SHOW

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U. S. A.

Branch Offices: **Boston · Buffalo · Chattanooga · Chicago · Cleveland · Detroit · New York · Philadelphia · St. Louis**

THE USE OF AJAX PHOSPHOR-COPPER

Send for booklet
"INGOT METALS OF TODAY"

●

15 STANDARD ALLOYS BY AJAX

Ajax Tombasil
Ajax Plastic Bronze
Ajax Anti-Acid Bronze
Ajax Phosphor Bronze
Ajax Red Brass Ingots
Ajax Manganese Bronze
Ajax High-Tensile Manganese Bronze
Ajax Golden Glow Yellow Brass
Ajax Nickel-Copper 50-50%
Ajax Manganese Copper
Ajax Aluminum Alloys
Ajax Phosphor Copper
Ajax Silicon Copper
Ajax Nickel Alloys
Ajax Phosphor Tin

NOTE

"Proper Melting Decreases Foundry Losses," contains interesting data. Also, the booklet, "Nonferrous Ingot Metals of Today." Write for both of these. They are free.

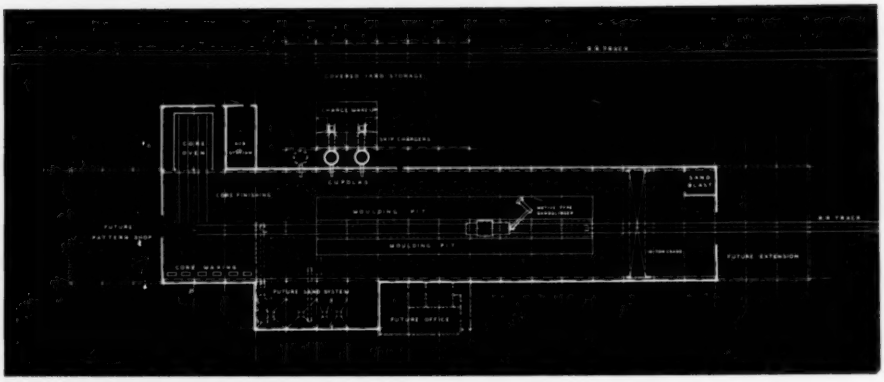
Successful foundrymen deoxidize or "clean up" molten metal by a scientific method worth using *as indicated:*

They use phosphorus . . expertly . . in the form of "Ajax Phosphor Copper" . . added as the crucible is removed from the furnace . . for virtually all brass and bronze alloys.

In notched waffle sections, or in shot form, Ajax 15% P-Cu does its work at .01% (1 oz. per 100 lbs.). Introduced, and having time to react when stirred with a whirling motion of the skimmer, it causes oxides to rise for effective removal by skimming from the surface. It is best to avoid phosphorus build-up from back stock.* . . If you use phosphorus these days, use Ajax Phosphor Copper (useful also in producing your phosphor bronze)

THE **AJAX** METAL COMPANY
ESTABLISHED 1880 PHILADELPHIA

ASSOCIATE COMPANIES:
AJAX ELECTRIC FURNACE CORPORATION, *Ajax-Wyatt Induction Furnaces for Melting*
AJAX ELECTROTHERMIC CORPORATION, *Ajax-Northrup Induction Furnaces for Melting, Heating*
AJAX ELECTRIC COMPANY, INC., *Electric Salt Bath Furnaces*
AJAX ENGINEERING CORPORATION, *Ajax-Tama-Wyatt Aluminum Melting Furnaces*



Martin Foundries Co., Detroit, Michigan

This Gray Iron Foundry, recently completed and now in operation, was engineered, utilizing the Owner's operating know-how and the foundry engineering experience of Giffels & Vallet, Inc., to provide efficient production facilities for present requirements and for convenient future expansion.

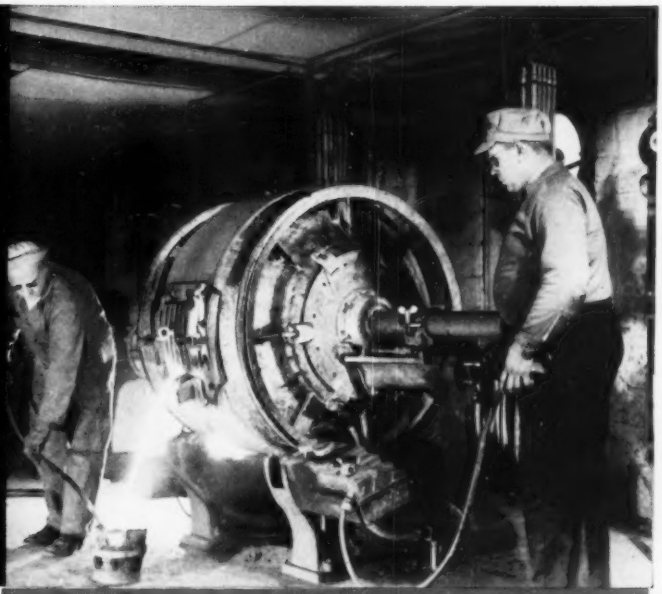
The foundry engineering experience of Giffels & Vallet, Inc. is available to obtain desired objectives in your plant. We will gladly, without obligation, discuss your foundry problems and the assistance we could render.

GIFFELS & VALLET, INC.
INDUSTRIAL ENGINEERING DIVISION
1000 MARQUETTE BUILDING, DETROIT

No pigs

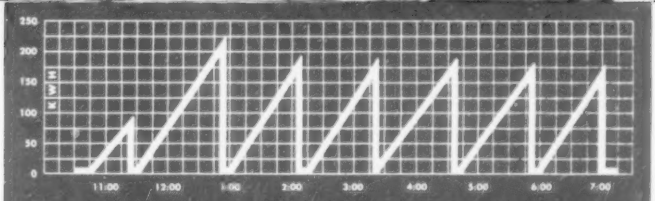
in 168,930 lbs. of synthetic alloy iron

A DETROIT ROCKING ELECTRIC FURNACE Melts Scrap with Economy and High Uniformity



No pigs were used in the production of 168,930 lbs. of uniform quality synthetic alloy iron by the Detroit Rocking Electric Furnace shown above. All charges were of scrap and graphite only.

Big savings were made on raw materials. Melt quality and homogeneity were rigidly maintained by automatic control.



One month's operation of type LFY, 175 KW, 700 lb. nominal cold charge capacity Detroit Rocking Electric Furnace. High strength, alloy automotive irons poured at 2800-3000° F.

• No. heats per day—7 • Av. heat weight—1000 lbs. • Total lbs. cold melted—168,930 • Av. power consumption, including preheat—549 KWH/ton • Total average cost for power, refractories, and electrodes, $11.41/ton.

NOTE: *Operator handles two such furnaces all day. Furnaces are equipped with automatic electrode control as well as automatic rocking control.*

Get Multiple Savings

In your melting operations, you'll achieve better castings, fewer rejects, higher usable yields with Detroit Rocking Electric Furnaces. Faster melts mean more heats per day.

Because the electrodes are always clear of the molten bath, carbon pick-up is eliminated. Indirect arc and automatic electrode adjustment result in optimum power use. All-electric operation excludes costs of handling and storing bulky fuels. Control of interior atmospheres assures peak quality.

Linings last longer. Replacement linings are installed quickly, with least out-of-production time.

Increase YOUR Profits!

Whether you melt ferrous or non-ferrous metals, Detroit Rocking Electric Furnaces will give you top melting economies. Send us your production data. Our engineers will furnish facts on how you benefit through better quality control, greater production, with Detroit Rocking Electric Furnaces. Available with conical or cylindrical chambers, in capacities from 10 to 4000 lbs. Write, now, to:

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.

FOR FASTER PRODUCTION OF

DELTA

Scientifically Developed

SPECIALIZED FOUNDRY PRODUCTS

DELTA PRODUCTS for the FOUNDRY are PRODUCTS OF RESEARCH. During the past sixteen years many important scientific developments . . . valuable contributions to the advancement of foundry practices . . . have originated in DELTA'S laboratories where the most modern scientific facilities play a vital part in a continuing program of product research, development and standardization.

Every DELTA Foundry Product is first tested by laboratory methods and then submitted for use and final approval in ACTUAL FOUNDRY PRACTICE. before it is identified with the name "DELTA".

There is no "just as good" substitute for any DELTA Core and Mold Wash just as there is no substitute for DELTA'S scientific laboratory control of production which safeguards the quality and uniformity of all DELTA Foundry Products. DELTA Research laboratories developed, and pioneered the use of, Plastic-type Core and Mold Washes . . . and still leads the field in the development of new products for improved foundry practices.

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54th ANNUAL A. F. S. FOUNDRY CONGRESS & SHOW • CLEVELAND, MAY 8-12, 1950

DELTA OIL PRODUCTS CO.

FINER-FINISH CASTINGS AT *Lower Cost*

Delta Technical Men will be at the booth to answer your questions and discuss with you problems relative to foundry practice. Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

CORE AND MOLD WASHES:

FOR STEEL:

Delta Special Core & Mold Wash Base — Used by more steel foundries than all other types of washes combined.
Delta SteelKoat, a finished high fusion waterproof wash.

FOR ALL TYPES OF SAND CAST METALS:

Delta ThermoKoat — It's plasti-lastic, non-heat shocking, highest fusion and hot strength.
Delta Z-Koat, a zirconium wash with unusual properties in contact with molten metal.

FOR GRAY IRON, MALLEABLE, BRONZE AND BRASS:

Delta GraKoat, no reaction with molten metal.
Delta BlacKoat, a black wash, free from carbon, no gas in contact with molten metal.

FOR GRAY IRON:

Delta BlacKoat S-5, a new and different wash. Produces results, on gray iron castings, unequalled by any other wash.

FOR NON-FERROUS AND LIGHT METALS:

Delta NonferrusKoat, produces unusually smooth surface castings.

PARTING COMPOUNDS:

Delta Partex (Nutshell partings) has lycopodium properties, non-injurious and non-hazardous to use.

Delta Liquid Parting — Low cost, highly effective and lasting.

Delta Sand Conditioning Oil — Sticking core sand mixes work freely in core boxes when sand conditioning oil is added to core sand mixes.

MUDDING & PATCHING COMPOUNDS:

Delta Sliktite — A light colored mud for all types of metal castings.

Delta Ebony — A black mud for gray iron, malleable and nonferrous work. All mudding compounds seal core joints and hold joints together at high temperatures.

NO-VEIN COMPOUND:

A special compound, not iron oxide. A high hot strength and sand plasticizing material. Stops veins and penetration.

MOLD SURFACE BINDERS — LIQUID:

Delta Spray Binders — Produce dry sand mold results by surface spraying of green sand molds.

PERMI-BOND ELIMINATES SEA COAL NUISANCE:

The new modern scientific sea coal replacement.

BONDITE PRODUCES A REDUCING MOLD ATMOSPHERE:

For Steel and Gray Iron — Use Delta Bondite, a dry binder which becomes waterproof on drying and produces mold atmosphere which is high in reducing gas.

CORE ROD DIP OIL NO. 224X TIES CORE RODS AND WIRES INTO THE CORES:

Rods and wires coated with Delta Core Rod Dip Oil adhere to the sand. Eliminates need for 50% of the rods and wires and reduces core breakage.

CORE OILS:

High tensile, low gas, faster baking, exceptionally economical to use.

DRI-BOND:

A new type of Dry Binder which provides new economies. Fast-baking, reduces veining and penetration. Can be used with old sand equally as well as with new sand.

MILWAUKEE 9, WISCONSIN

for improved casting finish *with no burn-ins, flash or fins . . .*

use Stevens

SLICK-SEAL MUDDING COMPOUND

you'll get **performance plus!**

"Performance *plus* what?" you might ask. We hope you do . . . hope you're interested enough to let us demonstrate the many benefits to be derived through your use of Stevens SLICK-SEAL mudding compound.

First, there is the convenience of using a compound that remains plastic and workable during an entire 8-hour shift. Yet, light applications of SLICK-SEAL air-dry in from 1 to 2 hours; heavy applications take only 4 to 5 hours.

Coremakers have a special word to describe its application qualities on pasted joints, core crevices and rough core surfaces. "Slick," that's the word and that's the way SLICK-SEAL goes on, smooth and easy with no crumbing, rolling or balling up behind thumb or finger. It leaves the hands clean . . . a most important advantage to women core workers.

Feather edges do not shrink or curl when subjected to oven or metal heat. Flowing metal can't dislodge SLICK-SEAL, cause it to flake, peel or spall off. SLICK-SEAL positively prevents fins or burn-in at pasted joints, because the compound itself is an excellent, high heat resistant facing. Covered by a core wash or not . . . *it improves metal finish.*

ORDER SLICK-SEAL TODAY . . . at our risk!

If you do not find it to be superior to the compound you're now using, return any unused portion for complete credit or your money back. *You must be satisfied!*

Visit the Stevens Booth, 1207 AFS Foundry Show at Cleveland, May 8th to 12th.

SINCE 1882 STEVENS INCORPORATED EVERYTHING FOR THE FOUNDRY DETROIT 16 MICHIGAN

LEADING MANUFACTURERS AND DISTRIBUTORS OF FOUNDRY FACINGS, EQUIPMENT AND SUPPLIES

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CLAUDE B. SCHNEIBLE COMPANY
P.O. BOX 502 DETROIT 32, MICHIGAN

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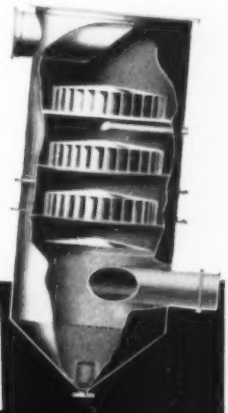


SCHNEIBLE

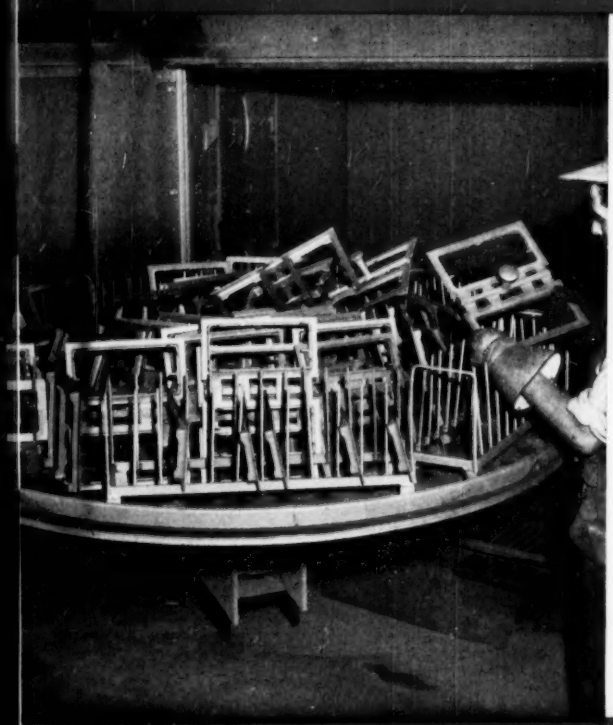
AT THE MAJESTIC CO.,

WHEELABRATOR® Saves $9,525.00 per year

	FORMER METHOD	WHEELABRATOR METHOD
MACHINE	8 tumbling mills	66" Wheelabrator Swing Table
PRODUCTION	125 tons per month	125 tons per month
LABOR	2 men at 9 hours each 18 man hours daily	1 man at 8 hours — 8 man hours daily
CLEANING COST	Per Ton — $13.29	Per Ton — $6.94

SAVINGS

per ton
$ 6.35
per month
$ 793.75
per year
$ 9525.00



Gray iron castings—125 tons per month—ranging in weight from a few ounces up to 400 pounds are cleaned in Majestic's foundry for use in their building specialties such as coal chutes, indoor and outdoor fireplaces, incinerators, etc., as well as for their complete line of heating equipment.

Since the Wheelabrator Swing Table was installed the bulk of their production changed from large, heavy furnace work to thousands of small, relatively fragile pieces. According to Mr. Claude Morgan, Plant Supt., it would have been impossible to operate the foundry profitably without the Wheelabrator Swing Table—breakage would have been prohibitive and labor costs excessive.

Costs go down — profits go up, when you use Wheelabrator. Write today for information on how you, too, can use a Wheelabrator, the amazing airless blast machine that pays for itself.

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

American

Huntington, Indiana

DUSTUBE

Increases Production..

..Cuts Insurance Rates..

..Improves Working Conditions

See what these officials at Majestic say:

Mr. Claude Morgan, Plant Superintendent

"Equipment we purchase is ordinarily installed for a specific purpose and it usually performs satisfactorily. The performance of our Dustube Dust Collector which ventilates all operations in our cleaning room, however, provides many important benefits: (1) Eliminates a severe dust condition: (2) Provides employee comfort and increases production through better working conditions: (3) Decreased insurance rates; (4) Reduces cost of housekeeping by preventing dust to escape into the atmosphere. The other advantages can be lumped into this statement that 'the Dustube more than pays its own way.' "

Mr. C. L. McWhorter, Foundry Foreman

"The performance of the Dustube has been so outstandingly satisfactory that I must admit its continual high efficiency and low cost operation is taken for granted. If we had some trouble occasionally, the benefits would be more apparent and appreciated. Naturally, we're proud of the dust-free conditions in our cleaning and grinding room which means so much in making the foundry a good place to work."

Mr. Geo. Shutt, Maintenance Foreman

"We have had absolutely no trouble with the Dustube whatsoever — no new parts have been required in nearly two years of steady operation. Inspections made monthly reveal that there is no cloth wear and we should get many, many more years of trouble-free operation from the unit. All the working parts are readily accessible which makes possible quick, positive inspection and necessary lubrication."

On-the-job performance proves that Dustubes meet the most exacting requirements for simplicity, economy and efficiency. This is a combination that pays off in dollars as well as improved working conditions. To find out how a DUSTUBE can make money for you, have an AMERICAN representative call at your convenience.

DUSTUBE ADVANTAGES

BETTER DUST REMOVAL — Simple, fast, thorough. Shortens cleaning time.

POWER SAVINGS — Lower resistance to air flow. Lower air velocities.

HIGH EFFICIENCY — Nearly 100% efficient by convincing tests.

EASE OF INSPECTION — Clean, safe, simple. No parts to remove.

DUSTUBE FILTERS — No abrading metal contact. Easy to ship, store and handle.

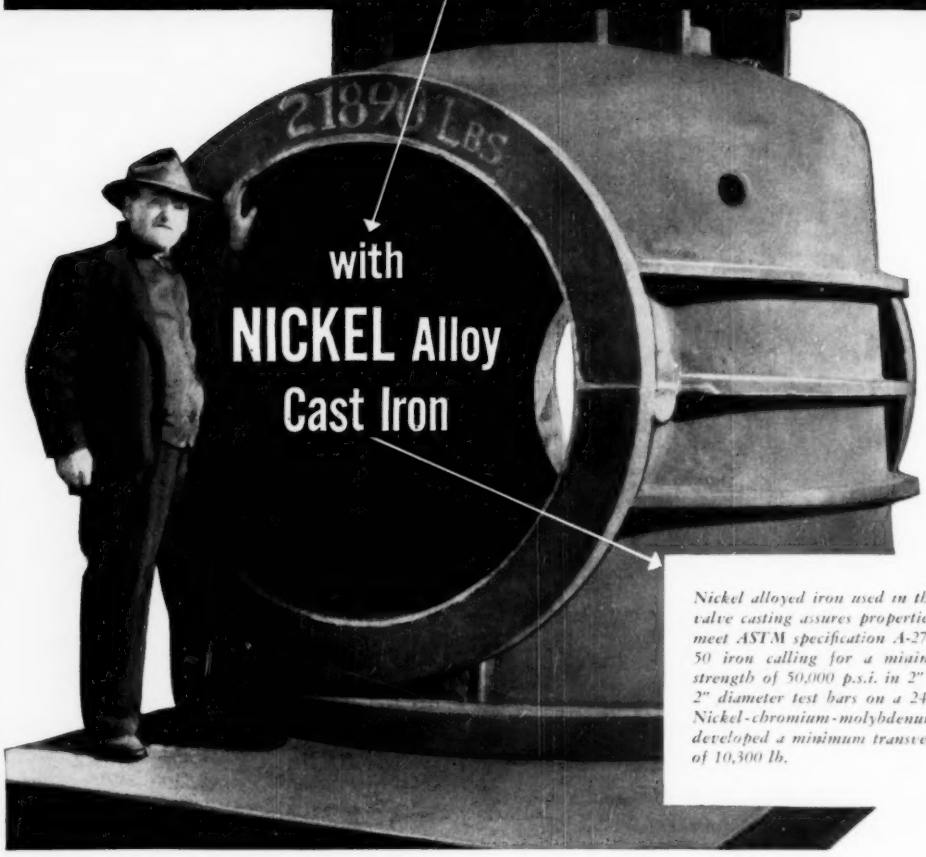
FILTER REPLACEMENT — Takes only a few seconds. Requires no tools.

WHEELABRATOR & EQUIPMENT CORP.

630 S. Byrkit Street Mishawaka Indiana

FEMA

Kutztown Meets Specifications for Delaware Aqueduct Job



Nickel alloyed iron used in this 54" rotovalve casting assures properties needed to meet ASTM specification A-278-44T Class 50 iron calling for a minimum tensile strength of 50,000 p.s.i. in 2" sections. In 2" diameter test bars on a 24" span, this Nickel-chromium-molybdenum cast iron developed a minimum transverse strength of 10,300 lb.

Rotovalve bodies and plugs and related castings meeting every specification of New York City's Board of Water Supply, were produced by the Kutztown Foundry and Machine Corporation, Kutztown, Pa., in high test Nickel alloyed cast iron.

This is but one of thousands of examples that show how Nickel cast iron renders these basic advantages:—

IN THE FOUNDRY—Nickel aids the progressive foundry to meet high mechanical property specifications. It is employed in the production of engineering cast irons because it strengthens the pearlitic matrix of the iron, produces finer and more highly dispersed graphite and discourages the formation or retention of hard carbide particles.

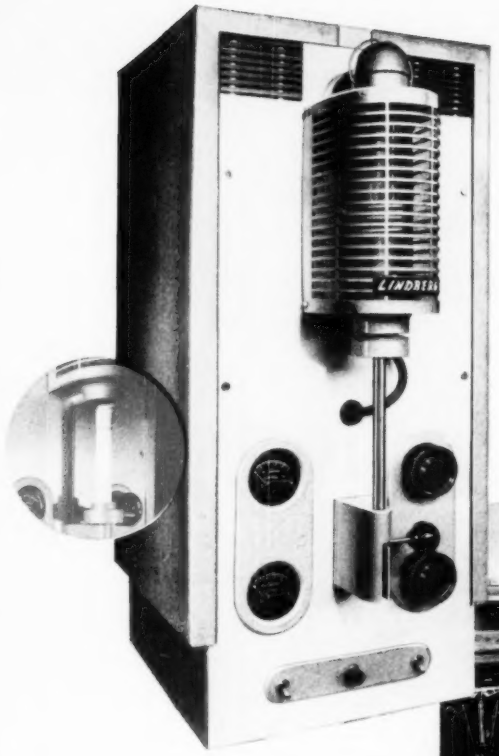
IN THE MACHINE SHOP— Nickel cast irons provide readily machinable castings that take a smooth finish because of their improved structure and uniformity, particularly where changes in cross-section introduce difficulties and losses with unalloyed irons.

IN SERVICE LIFE—Nickel cast irons are strong, pressure-tight and resistant to graphitic corrosion, a frequent source of trouble in valves, pipes and fittings.

EMBLEM OF INCO SERVICE
TRADE MARK

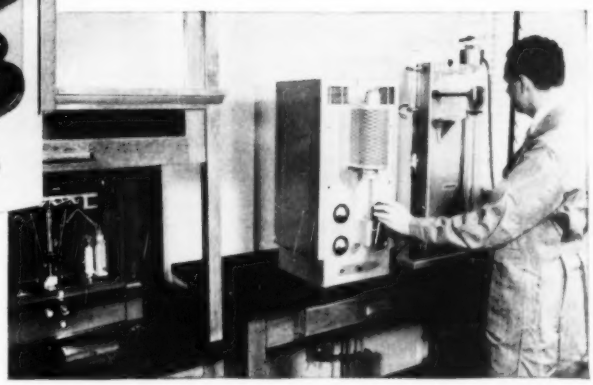
Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.



INSTANT IGNITION

of Solid Samples



Typical laboratory installation. A Lindberg Volumetric Carbon Determinator operating with a Lindberg "H-F" Combustion Unit

The Lindberg "HF" Combustion Unit is revolutionizing carbon and sulphur determinations in laboratories throughout the country. Ready for instant use—instant temperatures above 3000° F.—for steel, cast iron, alloys, or stainless samples—volumetric or gravimetric!

A high frequency unit specially designed for the laboratory

- Ready in the morning in 57 seconds—instantly from then on.
- 90% less power consumption (maximum input 0.125 KW idling).
- Glass combustion tube provides visability of operation.
- Combustion tubes at half the cost, last many times longer.
- Shorter tubes advantageous for volumetric method.
- No elements to burn out or limit temperatures.
- Heats nothing but the sample.
- Eliminates excess heat from the laboratory.
- Inexpensive "cupelet" holds full factor weight for carbons.
- Small and compact—13" wide—28½" high—17" deep.

For further details ask for Bulletin 910.

LINDBERG LABORATORY DIVISION

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ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How CHROMIUM and TUNGSTEN Increase Strength of High-Temperature Alloys

The aircraft field has served as an important "proving ground" for the high-temperature alloys that have been developed for gas turbines required to operate at elevated temperatures. However, these alloys are now demonstrating their superior properties for other primary power applications, including gas turbines to operate electrical generators for stationary or motive power.

While there are literally dozens of different alloys available for high-temperature use, most of them contain the alloying elements chromium and tungsten for the express purpose of enhancing resistance to scaling and increasing their hardness and strength at elevated temperatures. The amount used is generally determined by the stresses and temperatures expected in service. Other alloying metals may also be added for special purposes — such as columbium, manganese, silicon, and titanium.

Chromium and Tungsten as Strength-Builders

Even small amounts of chromium and tungsten are effective in increasing the strength of high-temperature alloys. An important consideration is, of course, the exposure time—particularly when operating temperatures go above 1200 degrees Fahrenheit. Although the major role of chromium is to prevent scaling, it has been found that chromium, as well as tungsten, also helps the alloys to maintain their strength when they are exposed to high temperatures for long periods of time.

In addition to chromium and tungsten, the combination of other alloying metals present will likewise influence the strength of the alloys. Heat-treatment, too, will influence the properties of these materials. However, in obtaining the higher ranges of strength needed at extremely high temperatures, chromium and tungsten are essential.

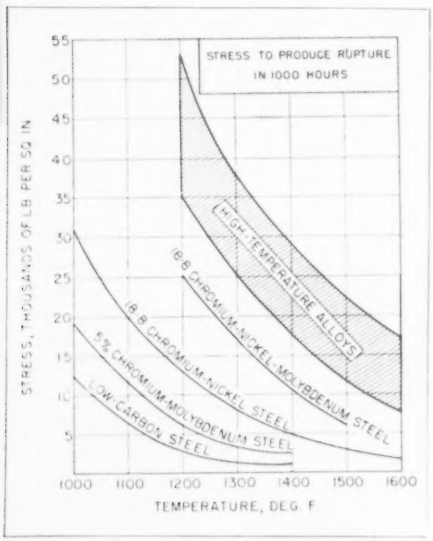

Fig. 1—Here is the average range of strength of various high-temperature alloys compared with other metals.

Where High-Temperature Alloys Are Used

Special high-temperature alloys containing chromium and tungsten are being used for the construction of gas turbines that power railroad locomotives, ships, airplanes, and electric generating plants. Some typical parts made of these alloys are rotors, turbine blades, nozzle vanes, ducts, and housings. These parts are exposed to temperatures of from 1200 to 1500 degrees Fahrenheit.

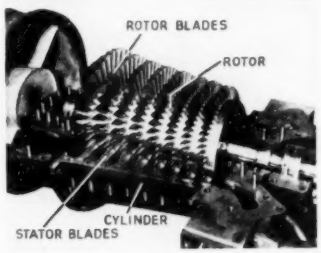

Fig. 2—Rotor and stator blades in this locomotive-type gas turbine are precision-cast of an alloy containing about 24 per cent chromium and 6 per cent tungsten. The rotor body and cylinder housing are forged from an alloy containing about 19 per cent chromium and 1.2 per cent tungsten.

If You Need Technical Help

Those producing high-temperature alloys who wish technical help in the selection of alloying metals will find ELECTROMET's metallurgists glad to cooperate. In addition to chromium and tungsten alloys, ELECTROMET also produces ferro-alloys of columbium, manganese, silicon, and titanium for use in making high-temperature alloys. If you wish further information about the properties and uses of these alloys, write to the nearest ELECTROMET office.

Ask for our new catalog "Electromet Ferro-Alloys and Metals." It describes over 50 metals and alloys produced by ELECTROMET and tells of the unique technical service offered to the metal industries.

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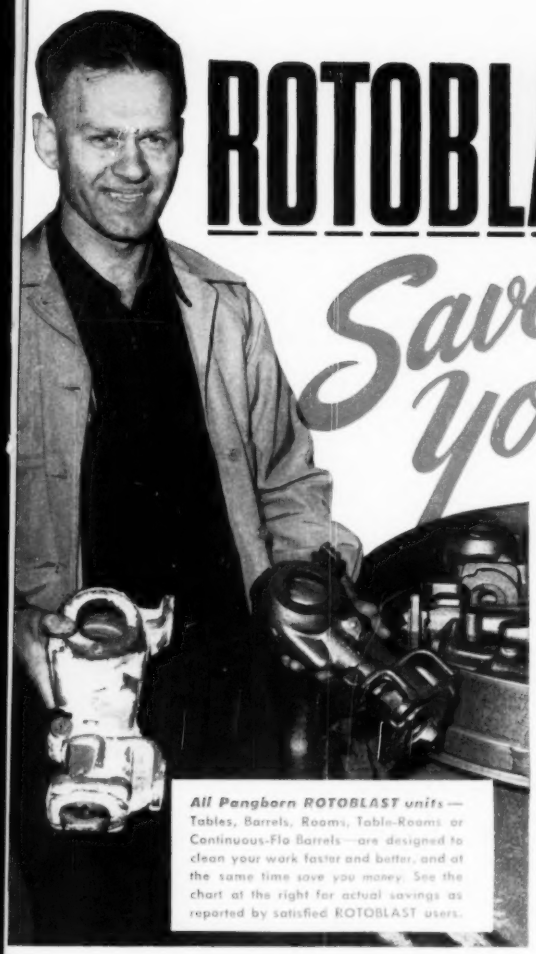

All Pangborn ROTOBLAST units — Tables, Barrels, Rooms, Table-Rooms or Continuous-Flo Barrels — are designed to clean your work faster and better, and at the same time save you money. See the chart at the right for actual savings as reported by satisfied ROTOBLAST users.

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USERS REPORT IMPRESSIVE SAVINGS WITH ROTOBLAST

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Table-Room	**$11,102** on labor alone	Lewistown Foundry, Lewistown, Pennsylvania
Room	**$10,160** on labor alone	Harris-Seybold, Cleveland, Ohio
Barrel	**$5,080** on labor alone	Yates-American Machine Co., Beloit, Wisconsin

Yes—ROTOBLAST offers the ideal solution to *your blast cleaning problems*. Cleaning efficiency is equally high, whether you operate at 50% or full capacity. To get *faster blast cleaning* in your plant—specify Pangborn ROTOBLAST!

GET THE FACTS! Find out how much money *you* can save with ROTOBLAST. Bulletin 214 contains technical details. Or send us your problem and we'll show you how ROTOBLAST can solve it. But write today . . . just address PANGBORN CORPORATION, 1408 Pangborn Blvd., Hagerstown, Md.

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- **SAVES LABOR:** *One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.*
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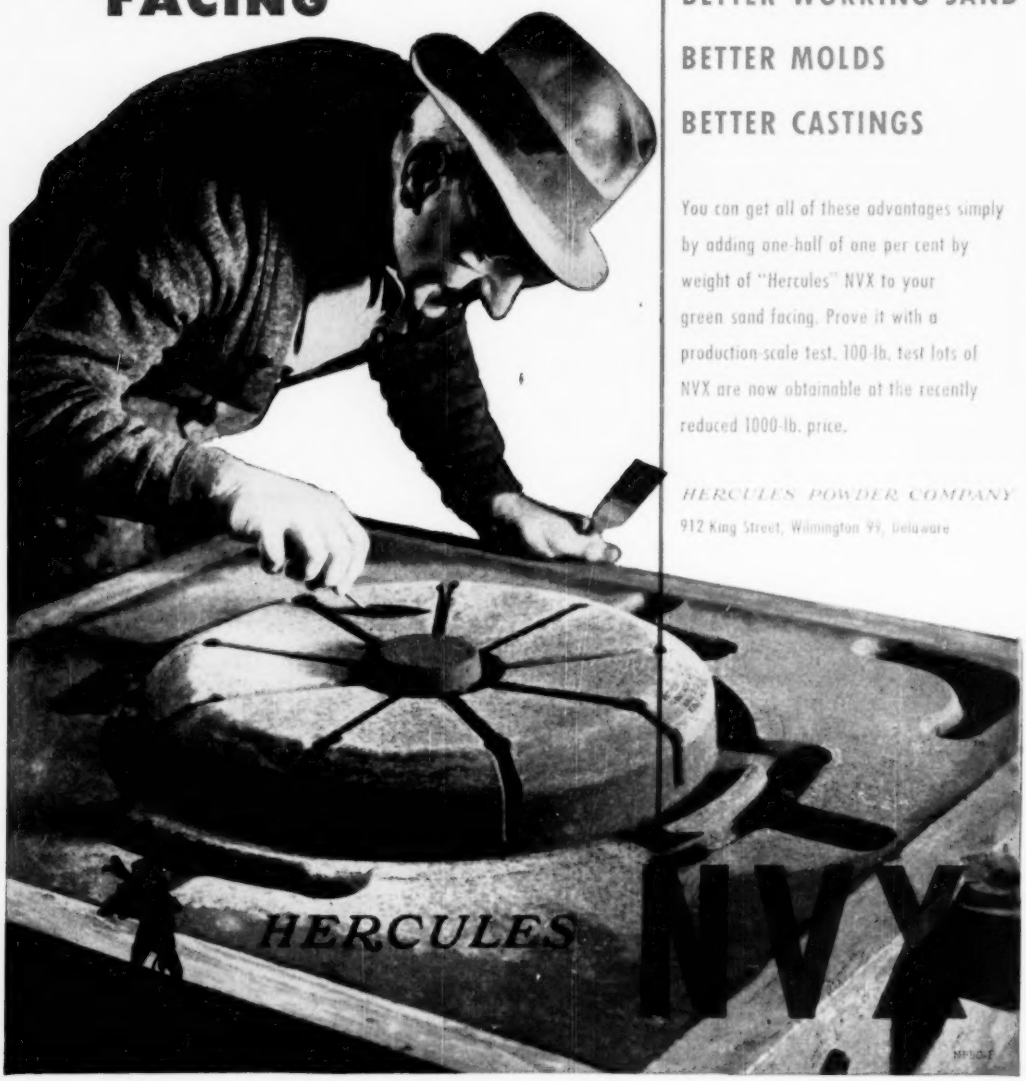

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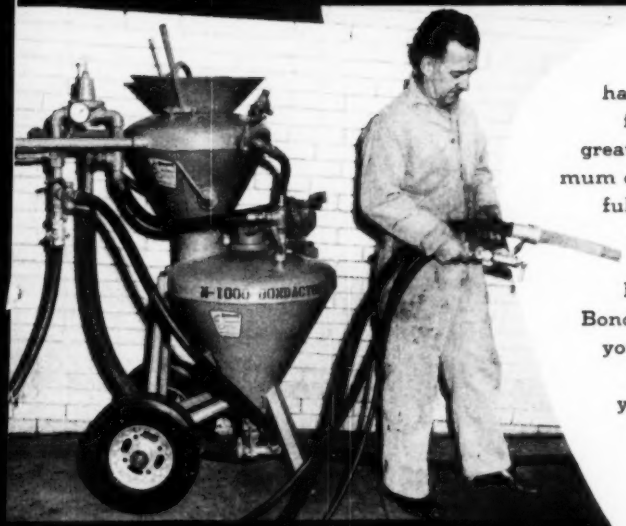

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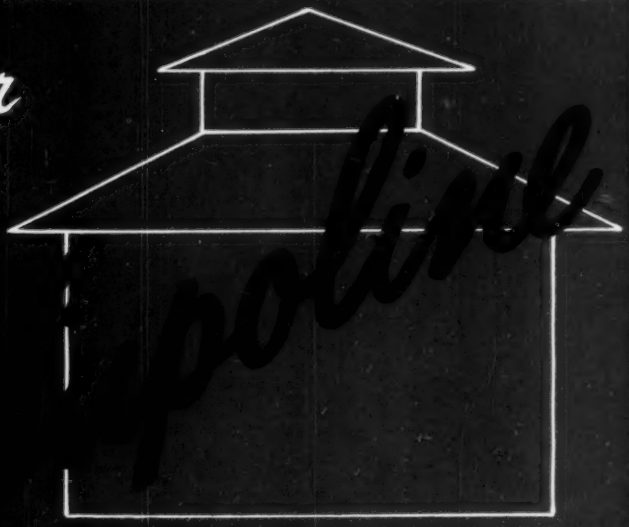

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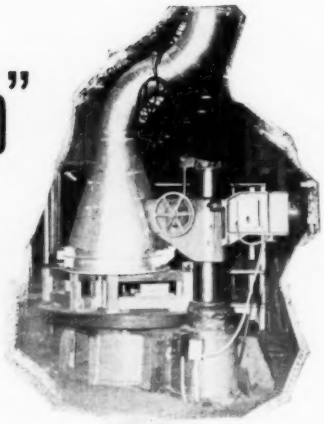

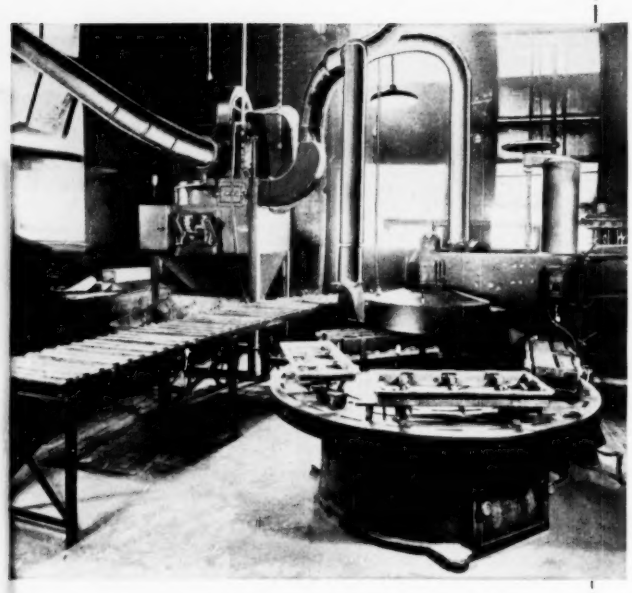

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Fig. 117—Bench-type Core Blowing Machine

Fig. 190—High-frequency Dielectric Core Baking Oven

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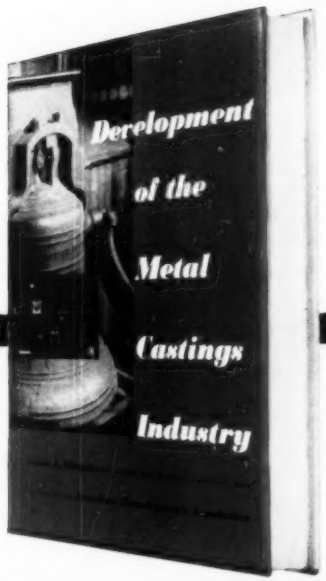
STEMS FROM AN APPRECIATION OF HISTORICAL BACKGROUND



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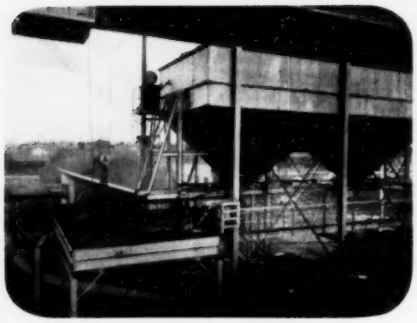
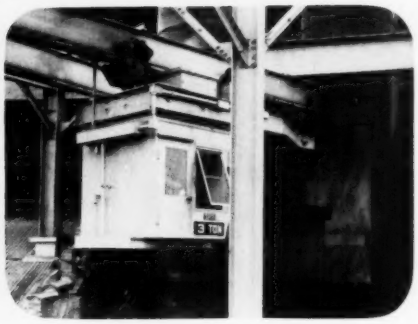
MAKE-UP and CHARGING

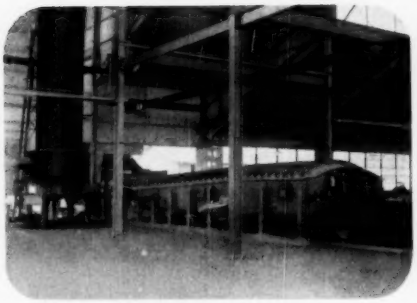


Whiting Equipment handles the charge from yard to cupola. Here a magnet crane is making up the metal charge.

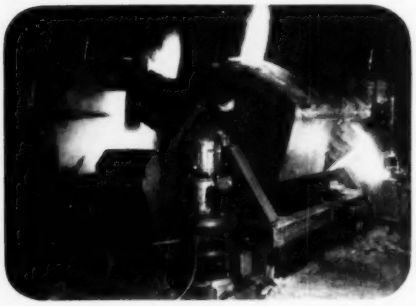


Whiting Mechanical Chargers range from simple skip hoists for a single cupola, to swivel, crane, and monorail chargers.

MELTING and HOLDING



For hot metal at low cost, Whiting Duplexing is available in many combinations—above is cupola to air furnace.



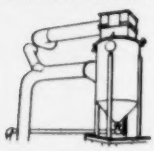
The Whiting Heated Metal Mixer provides uniform hot metal—a real boon where light, thin-section castings are poured.

WHITING Corporation

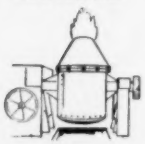
15628 Lathrop Ave. • Harvey, Illinois

MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION

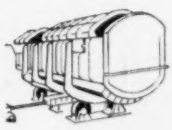
DUST SUPPRESSORS



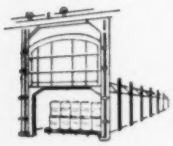
CONVERTERS



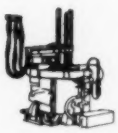
CRADLE FURNACES



ANNEALING OVENS

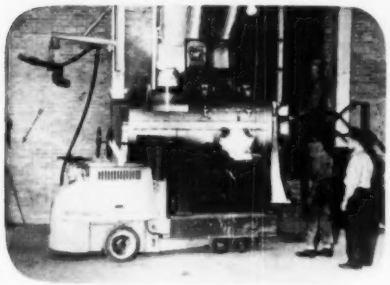


HYDRO-ARC FURNACES

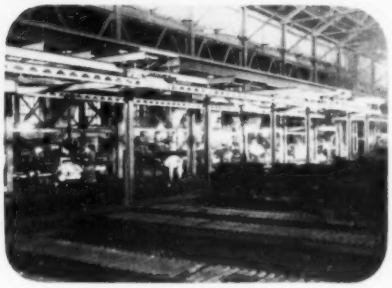


BY PRACTICAL FOUNDRYMEN

DISTRIBUTION and POURING

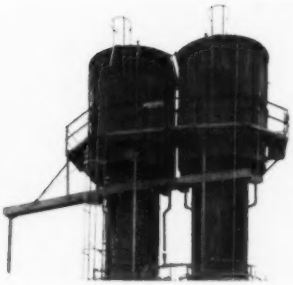


Here cupola metal flows into a Whiting Mixing Ladle from which it is poured into the distributing ladle. Whiting makes ladles for every foundry use.

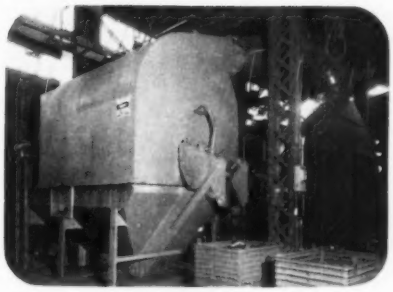


Whiting Ladles, Ladle Handlers, and Pouring Systems are designed for pouring ease, safety, and long life—engineered from years of practical foundry experience.

DUST SUPPRESSION



The Whiting Cupola Dust Suppressors control fly ash and sparks with water—reducing all solids to harmless sludge.

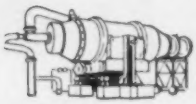


Hydro-Clone Dust Suppressors control foundry dusts at their source—at shakeouts, sand-handling systems, etc.

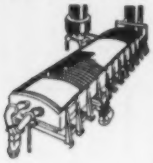
Send the coupon for free literature on any items of Whiting Foundry Equipment . . . or contact the nearest Whiting office if you want to talk with a sales engineer.

Offices in Chicago, Cincinnati, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.

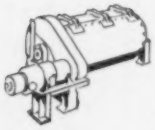
ROTARY FURNACES



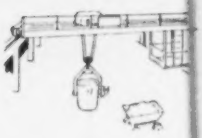
DUPLEXING SYSTEMS



TUMBLERS

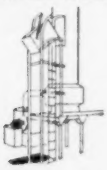


CRANES

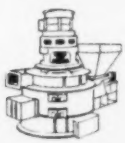


TRAMBEAM SYSTEMS

CUPOLA and CHARGER



PULVERIZERS



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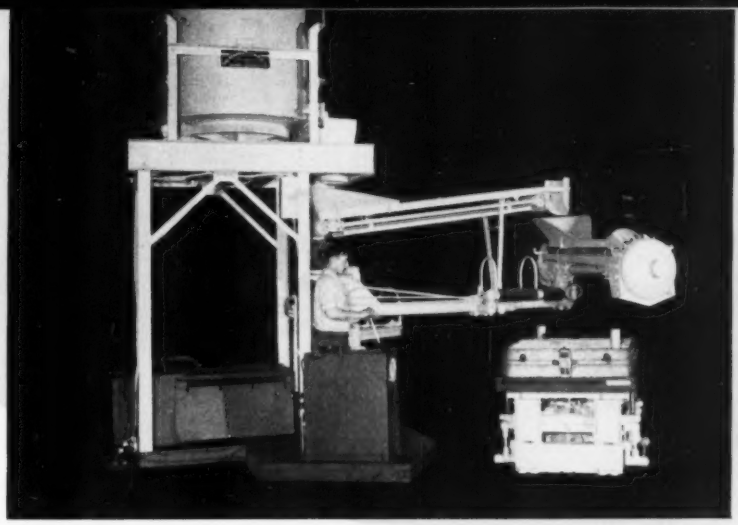


BETTER METHODS

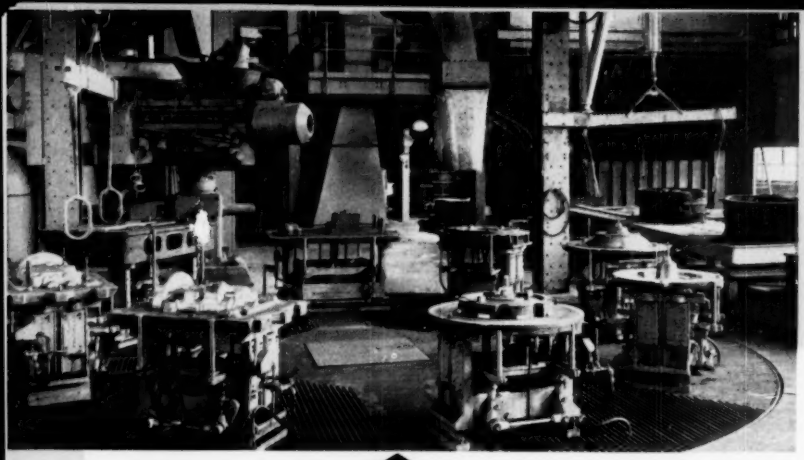
By BEARDSLEY & PIPER

At A.F.S. Foundry Congress and Show—Booth No. 1206 to 1208 and 1309 to 1311

The Junior Nite-Gang—The portable Junior Nite-Gang offers the same thorough sand conditioning as the Nite-Gang. This machine is loaded by front end loader, crane bucket, belt, shovel, or other means and has a capacity of approximately forty tons per hour.

The Nite-Gang—A self-propelled, self-feeding machine, the new Nite-Gang answers a long felt need in the foundry industry. It eliminates manual operations and provides *complete* conditioning . . . blending, magnetic separation, lump breaking, screening and aeration of up to forty tons of sand an hour. Wherever molding sand is prepared on the floor of the foundry, the Nite-Gang offers thoroughness of conditioning never before available.

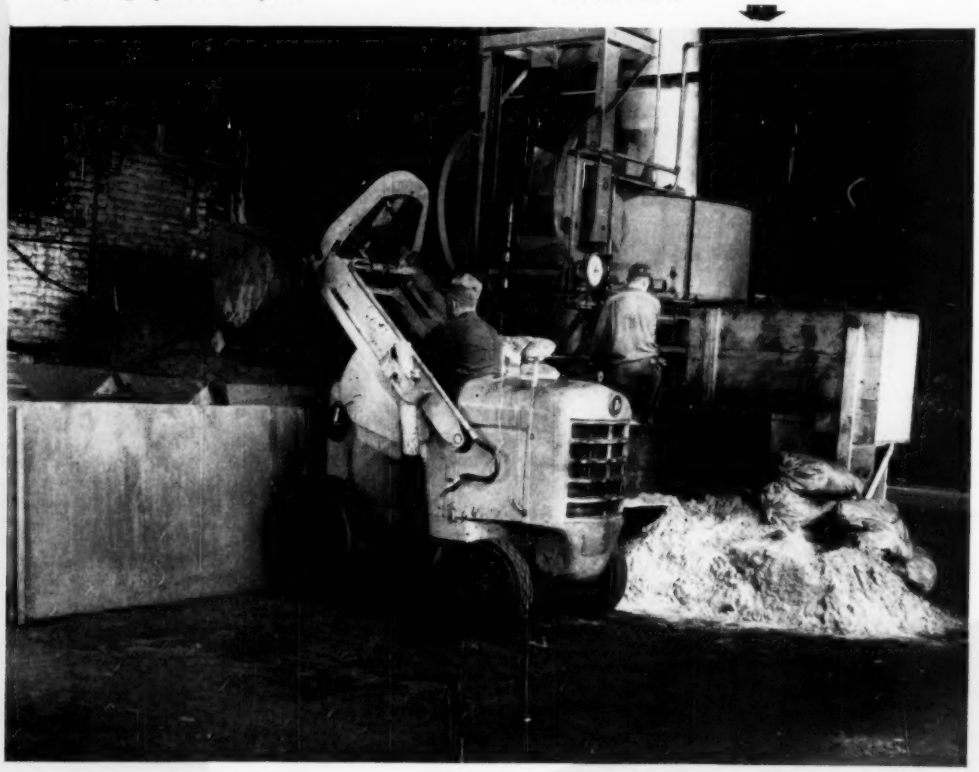
See other Better Foundry Methods on following pages!

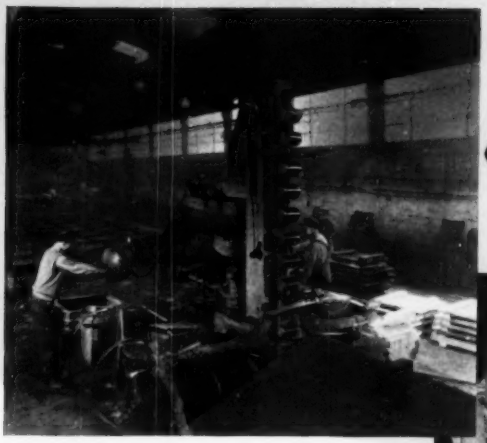


BETTER METHODS
By Beardsley & Piper

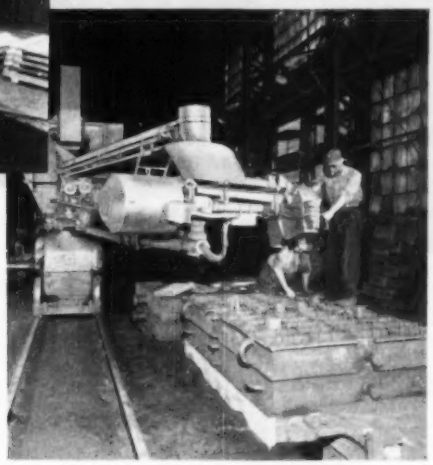
Multiple Station "Slinger" Installation—No other molding method offers the high production and flexibility of these units. Automatic and manually controlled Speedslinger multiple station installations produce molds at the lowest possible cost. Speedslinger, B&P Turntable and B&P Champion Speed-Draws are engineered and built as a team for maximum efficiency and coordination. The exceptional versatility of these units makes them adaptable to the widest variety of high production jobs.

Combination Sand Conditioning and Mulling Unit—Spearheading the new trend towards the use of all-purpose mulled molding sand, these package units offer all the sand conditioning advantages of a complete sand system at moderate cost. Built in six sizes, with capacities of six to sixty tons an hour, these Preparator-Speedmullor units screen, magnetically separate, aerate, completely mull and cool the sand.

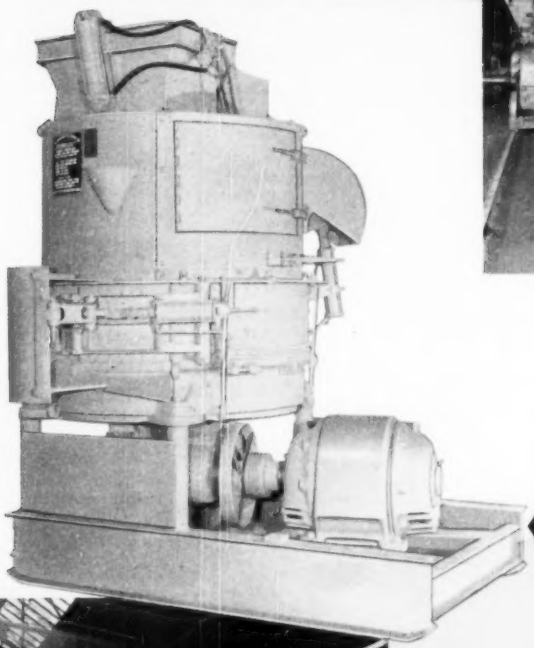




The Tractor Sandslinger
A completely self-contained unit, the Tractor Sandslinger is ideal for use in foundries having no auxiliary sand system. It blends, aerates and screens the sand and then rams it into molds with characteristic Sandslinger uniformity and hardness.



The Motive Sandslinger—One of the most popular Sandslingers for jobbing foundries, the Motive type provides the necessary flexibility for the ramming of molds and cores of greatly varying size.



The Speedmullor—Lowest original cost—lowest maintenance cost—lowest power cost per ton of sand—mulled to its ultimate physical properties. The Speedmullor completely mulls molding and core sands 4½ times as fast as any other sand mullor. Speedmullor cooling is the only really efficient and positive method of cooling while mulling . . . the only method in which cooling air passes *through* the mass of sand.

The Motive Speedslinger—Designed for ramming medium and heavy, pit and floor molds in jobbing foundries, the Motive Speedslinger has a greater range of operation and ramming capacity than any other molding method.

See other Better Foundry Methods on next page!

BETTER METHODS
By Beardsley & Piper

B&P

The Mulbaro—Thorough mulling, minimum sand handling, lowest initial and operating cost and *real* portability are just a few of the many Mulbaro advantages. Several barrows may be used alternately, thus providing the capacity of two or more mullors for slightly more than the cost of one.

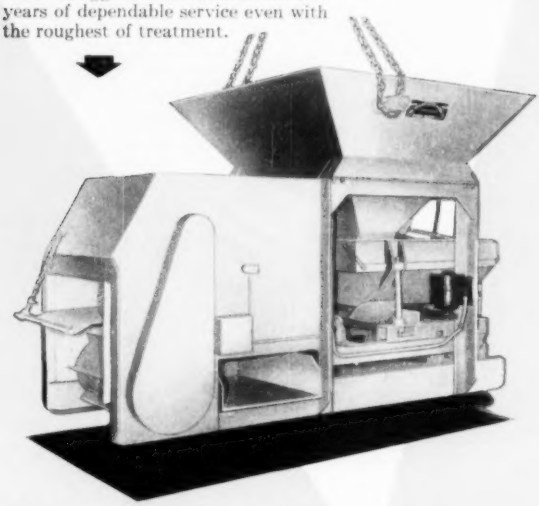
The Screenarator

Three Screenarator models provide capacities of 750, 1000 and 1500 pounds per minute of thoroughly screened and aerated sand. Thousands of low cost Screenarators are in service in foundries all over the world and have proved to be an unbeatable sand conditioning investment.

The Laboratory Mulbaro

The Laboratory Mulbaro thoroughly and uniformly mulls test batches facilitating close laboratory control of all sand supplied to the foundry. Two or more mixing bowls may be used with one machine permitting several mixtures to be prepared and tested without contamination of one batch by another and without loss of time. The removable mixing bowl and pivot mounted mulling mechanism permit easy cleaning.

The Preparator—The efficient, heavy duty, streamlined, portable Preparator screens, breaks lumps, magnetically separates, aerates and discharges up to sixty tons of sand an hour. Rugged construction assures years of dependable service even with the roughest of treatment.



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- ☐ Tractor Sandslinger
- ☐ Mulbaro
- ☐ Laboratory Mulbaro
- ☐ Screenarator
- ☐ Nite-Gang
- ☐ Junior Nite-Gang
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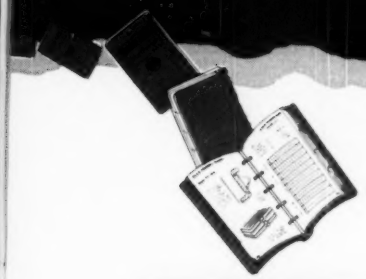

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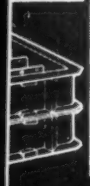

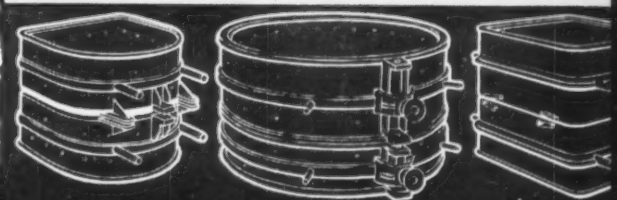

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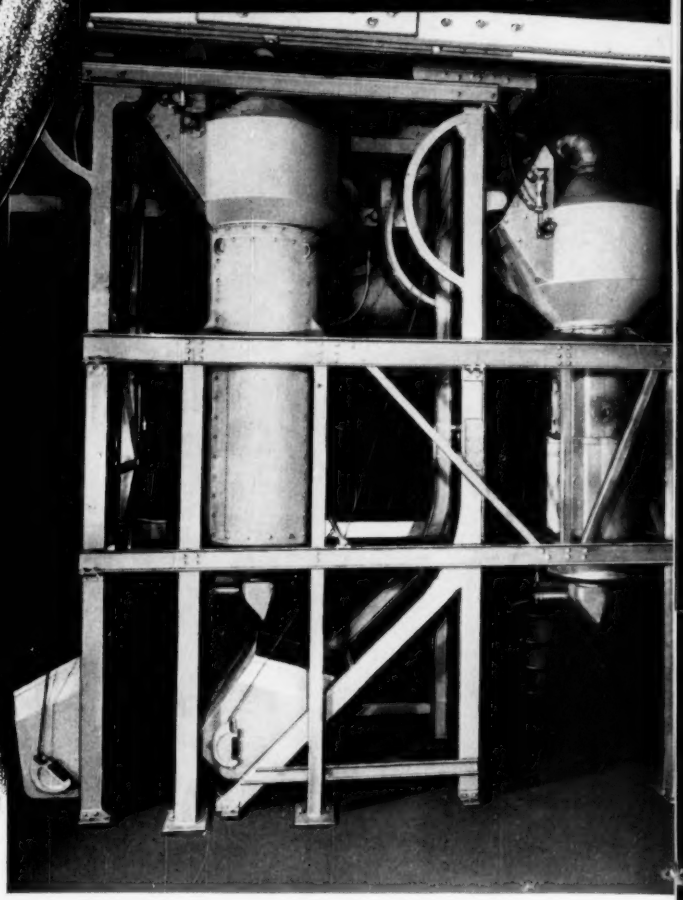
Sand Reclamation System



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A WORD for the FOUNDRY INDUSTRY

UNUSUAL is a good one-word description of the foundry industry. Some 5000 years old, it still uses techniques—like the lost wax process—whose origins have long been forgotten. Yet the industry is up-to-date and is constantly striving to develop new and better methods through individual and cooperative work.

Though foundry practice is not a profession, foundrymen have their own professional-type organization—the American Foundrymen's Society—and they conduct themselves along professional lines. Willingness to exchange information and ideas freely and cooperatively is characteristic of Society members and the concept was foremost in the minds of the far seeing men who organized A.F.S. in 1896. The attitude is professional and it has developed side by side with the foundry industry which has advanced farther in the past half century than during the rest of its history.

Once it was unheard of to compare notes, methods, and production figures. Today's foundryman willingly discusses his problems with others—to their mutual advantage. This exchange of information goes on formally and informally. Formally, it occurs to a considerable extent at the A.F.S. chapter meetings, the regional foundry conferences, and reaches an annual climax at the A.F.S. Annual Convention.

The 54th annual gathering of foundrymen interested in helping each other—the Society's Convention in Cleveland, May 8-12—as always provides foundrymen from all over the world an opportunity to publicly share and compare priceless knowledge of the art and science of their industry against a background of exhibits of the latest in foundry supplies and equipment.

The technical papers, round-table luncheons, and shop course sessions provide almost 100 opportunities for foundrymen to increase their "know how" and to develop their "know why". With virtually every job classification represented in the 10,000-member A.F.S., and with some 100 committees securing and screening the various papers, the Convention technical program offers a complete cross-section of current foundry technology.

Typifying the cooperative spirit are the reports on A.F.S.-sponsored research projects which will be presented during the Convention. Products of formal research conducted for the members of the Society and for the foundry industry, to whom the results are freely available, the reports are the culmination of the past year's work on a number of projects directed by top foundry talent from the various A.F.S. divisions and committees. These researches conducted today under Society auspices will form the basis of foundry techniques of tomorrow.

Running concurrently with the technical program is the exhibit of foundry equipment, supplies, and services—confidently predicted to be the most interesting and informative the Society and participating exhibitors have ever staged. One cooperative exhibit will operate on a 200-foot front and combine the facilities of four equipment manufacturers to show a complete production sequence from sand preparation to finished casting with sand reclamation included in the cycle.

The same spirit of cooperation which has marked the amazing development of the foundry industry and its products during the past 50 years is exemplified in this year's A.F.S. Foundry Congress and Show. And the five-day event is characterized by a word descriptive of the industry—unusual.

E. W. HORLEBEIN
National President
AMERICAN FOUNDRYMEN'S SOCIETY

President E. W. Horlebein—president of Gibson & Kirk Co., Baltimore, Md.—has long been active in affairs of the American Foundrymen's Society, serving as a member of the Board of Directors from 1948 until his election as vice-president in 1948, and as a member of the Executive Committee of the A.F.S. Brass and Bronze Division. He was instrumental in the formation of the Chesapeake Chapter; was its first chairman.

54

FOUNDRY CONGRESS & SHOW...

TECHNICAL, BUSINESS AND SOCIAL highlight of the foundry year is the forthcoming 54th Annual A.F.S. Foundry Congress and Show, to be held May 8-12 in Cleveland. Program of the 1950 Convention will feature five days of technical sessions, the Annual Banquet, Annual Business Meeting, Charles Edgar Hoyt Lecture, Northeastern Ohio Day, round table luncheons, shop courses, and the Chapter Officers and Directors, Canadian, Non-Ferrous "Father-Son", Educational and Alumni dinners, and a concurrent program of Ladies' Entertainment and visitations to foundries and pattern shops of the Cleveland area.

Registration fee for the Foundry Congress & Show will be $3 to A.F.S. members, $7 to non-members.

Among other metals organizations holding meetings in conjunction with the Convention are the National Castings Council, which will elect its officers for the coming year at a breakfast Wednesday morning, May 10; and Chicago's Cope and Drag Club, which will hold its first Convention meeting with a breakfast at 8:00 a.m., the same morning.

Foundry Show exhibits this year will be of outstanding interest to all foundrymen and will feature many operating exhibits and for the first time in many years equipment from overseas. (Details of the Foundry Show will be found on Page 78).

Non-Ferrous Shop Course the evenings of May 8 and 9, and the Non-Ferrous Founders' Society's "Son-Father" Dinner, May 8, open to all non-ferrous foundrymen attending the Convention.

Monday morning's session will feature two papers: *"An Investigation of Melting and Casting Procedures for High-Purity Nickel,"* by D. W. Grobecker, Los Alamos Scientific Laboratory, Los Alamos, N. M.; and *"Metal Melting—Application of Thermodynamic Principles to Melting Non-Ferrous Metals,"* by R. I. Moore, Wilson Brass & Aluminum Foundry Co., Toronto. Afternoon session will have *"Effect of Superheat and Casting Temperature on Properties of Tin Bronze,"* by B. N. Ames and N. A. Kahn, New York Naval Shipyard, Brooklyn; and *"Melt Quality Fracture Characteristics of 85-5-5-5,"* a progress report on the Brass & Bronze Research Project, given by F. B. Rote of the University of Michigan. In the evening, the first of two Non-Ferrous Shop Courses and the Non-Ferrous "Son-Father" Dinner will be held.

Tuesday's Brass and Bronze technical sessions will open with *"Metal Specifications for Brass and Bronze Foundry,"* by J. G. Dick, Canadian Bronze Co., Ltd., Montreal; and *"Aluminum Additions in Commercial Yellow Brass,"* by R. A. Colton and R. H. Gilbert, American Smelting & Refining Co., Barber, N. J.

CLEVELAND • MAY 8 to 12 • 1950

The Charles Edgar Hoyt Annual Lecture, highlight of the Convention technical program, will be presented at the conclusion of the Annual Business Meeting, May 10, by W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va., who will speak on *"Operation of the Cupola."* Already scheduled are the 1950 Exchange Paper of the Institute of British Foundrymen—*"Aluminum Alloy Castings, A Review of British Achievement,"* by Frank Hudson, Mond Nickel Co., Ltd.; and the Exchange Paper of the French Foundry Technical Association, which will be presented by Jean Maurice Laine, the French Foundry Technical Association.

Malleable

Malleable Division program plans call for three technical sessions on May 8 and 9, the annual Malleable Round Table Luncheon, May 9, and joint sponsorship with the Gray Iron Division of a symposium on nodular iron, May 10, at which speakers will be Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., on *"Problems in Producing Ductile Iron,"* and J. E. Rehder, Canadian Bureau of Mines, Ottawa, on *"An Introduction to the Annealing of Nodular Iron."* A similar joint Gray Iron—Malleable session will be held Friday, May 12.

Brass and Bronze

Opening Monday morning, May 8, the A.F.S. Brass and Bronze Division's program will consist of technical sessions on May 8 and 9, the annual Brass and Bronze Round Table Luncheon, and participation in the new

The Brass and Bronze Round Table Luncheon, May 9, will feature discussion lead by Howard F. Taylor, Massachusetts Institute of Technology, on "Casting Defects." The Division's program will conclude with the last Non-Ferrous Shop Course at 8:00 p.m.

Aluminum & Magnesium

Aluminum & Magnesium Division's two day program will comprise five technical sessions on May 8 and 9, the Aluminum & Magnesium Round Table Luncheon on May 8, and the Non-Ferrous Shop Course, new this year, to be held the evenings of May 8 and 9 and open free of charge to foundrymen of the Cleveland area as well as to Convention registrants.

Opening the Division's program on Monday, May 8, will be a showing of the A.F.S. film, *"Fluid Flow in Transparent Molds,"* with L. W. Eastwood of Battelle Memorial Institute, Columbus, Ohio, as narrator. The Aluminum and Magnesium Round Table Luncheon, to be held Monday noon, will feature a discussion of *"Test Bar Grating,"* with Walter Bonsack of Chicago as chairman. The Monday afternoon session will have M. W. Martinson and J. W. Meier of the Canadian Bureau of Mines, Ottawa, speaking on *"Magnesium Foundry Practice in Canada,"* and A. Juroff of Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., speaking on *"Equipment for Degassing Magnesium Alloy Foundry Melts."*

In the evening, the Non-Ferrous Founders' Society will sponsor the Non-Ferrous "Son-Father" Dinner. The evening session of the new Non-Ferrous Shop

A.F.S. 54 Foundry Congress

...ill climax the Division's first-day activities. ...ng the Aluminum and Magnesium Division's ...day, May 9, sessions will be *"New Al-Zn-Mg-Cu ...asting Alloys,"* by Walter E. Sicha and H. Y. Hunsicker of the Aluminum Co. of America, Cleveland. E. C. Reichard, American Smelting & Refining Co., Barber, N. J., and R. A. Quadt will present a paper on *"Corrosion and Stress Corrosion Properties of High-Strength Al-Zn-Mg-Cu Casting Alloy."*

Aluminum & Magnesium Division technical session, the afternoon of May 9, will feature the IBF Exchange Paper *"Aluminum Alloy Castings—A Review of British Achievement,"* by Frank Hudson, Mond Nickel Co., Ltd. The 4:00 p.m. session will feature *"Casting of Mg-Rare Earth-Zr Alloys in Sand,"* by K. E. Nelson and F. P. Strieter, Dow Chemical Co., Midland, Mich., and *"Development of High-Strength Mg Casting Alloy ZK61,"* by J. W. Meier and M. W. Martinson, Canadian Bureau of Mines, Ottawa, Ont.

Sand

A.F.S. Sand Division's program consists of three of the popular Sand Shop Courses, held the evenings of May 8, 9 and 11, and open to Cleveland area foundrymen without charge, technical sessions on May 9, 10 and 11, and a joint symposium with the Steel Division the morning of May 11.

Opening the Division's program will be the first of three Sand Shop Courses, Monday night, May 8. Technical sessions will begin Tuesday afternoon, May 9, with J. E. McMillan and J. A. Wickett, Monsanto Chemical Co., Springfield, Mass., speaking on *"Phenolic Resin Core Binders—Effect of Core Mix on Physical Properties"*; and *"Treatment of Bond Clays for Foundry Sand,"* by A. E. Pavlish, Kelly Island Lime and Transport Co., Cleveland.

Wednesday morning's program will open with *"Reproduceability of Foundry Sand Tests,"* by Bradley H. Booth, Carpenter Bros., Inc., Milwaukee, and Harry W. Dietert, Harry W. Dietert Co., Detroit; and *"Tenth Annual Report on Investigation of Properties of Steel Sands at Elevated Temperatures,"* by R. G. Thorpe and P. E. Kyle, Cornell University.

Thursday morning session, May 11, will have *"Flowability of Molding Sands,"* by W. H. Moore, Mechanite Metals Corp., South Euclid, Ohio; and *"Factors Affecting Molding Sand Density, Shrinkage and Workability,"* by R. P. Schauss and R. F. Baley, Illinois Clay Products Co., Chicago, and E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit.

Joint Steel and Sand Divisions' Symposium on *"Interpretation of Sand Tests as Related to Steel Castings,"* Thursday afternoon, will have two panels—one on Room Temperature Testing and one on High Temperature Testing. The last of three Sand Shop Courses will conclude the program Thursday evening.

Education

Educational Division's program calls for a Round Table Discussion session Tuesday afternoon, May 9, on *"High School and Trade School Training,"* with W. J. MacNeill, Dayton Malleable Iron Co.; J. H. Smith, Central Foundry Div., GMC; and Peter E. Rentschler, Hamilton Foundry & Machine Co., as discussion leaders. Speakers at the Educational Dinner,

May 9, will be F. W. Shipley and B. L. Bevis, Caterpillar Tractor Co., Peoria, Ill., on *"Foundry Apprentice Training at Caterpillar Tractor Co.,"* and N. J. Stickney, University of Wisconsin, on *"Engineering Student and Summer Foundry Work."*

Gray Iron

Gray Iron Division's program calls for three Gray Iron Shop Courses the evenings of May 8, 9 and 11, two joint sessions with the Malleable Division, the Gray Iron Round Table Luncheon, a joint session with the Steel Division and technical sessions on Thursday and Friday, May 11 and 12.

Opening technical session will be sponsored jointly with the Malleable Division the morning of May 10 and will be a symposium on nodular iron with Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., speaking on *"Problems in Producing Nodular Iron,"* followed by *"An Introduction to the Annealing of Nodular Iron,"* by J. E. Rehder, Canadian Bureau of Mines, Ottawa.

Gray Iron Round Table Luncheon will be held at noon May 10 with C. C. Sigerfoos, Michigan State College, leading a discussion on *"The Effect of Mold Materials on Metal Shrinkage."*

Thursday, May 11, technical Gray Iron speakers scheduled to date include Richard Schneidewind of the University of Michigan on *"Composition and Properties of Gray Iron;"* B. T. Malcolm and S. Low of the Chapman Valve Co., Indian Orchard, Mass., on *"The Relaxation of Cast Iron;"* R. A. Flinn and R. W. Kraft, American Brake Shoe Co., Mahwah, N. J., on *"Improved Test Bars for Standard and Ductile Grades of Cast Iron;"* and A.F.S. Gray Iron Division Chairman R. G. McElwee, Vanadium Corp. of America, Detroit, reporting on the work of the A.F.S. Cupola Research Committee. Concluding Thursday's Gray Iron program will be the last of the three Shop Courses.

Friday's Gray Iron sessions will include papers by R. G. McElwee, Vanadium Corp. of America, Detroit, on *"Correlation of Properties of Cast Iron;"* and S. F. Carter, American Cast Iron Pipe Co., Birmingham, on the *"Basic Lined Cupola."* Joint Gray Iron and Malleable session Friday afternoon will feature *"Dilatometer Studies of Nodular Cast Iron,"* by N. A. Ziegler, W. L. Meinhart and J. R. Goldsmith, Crane Co., Chicago; and *"Nodular Iron vs. Section Size,"* by Gosta Vennerholm, H. Bogart and R. Melmoth, Ford Motor Co.

Concluding Gray Iron session will be sponsored jointly with the Steel Division Friday afternoon with papers by C. F. Walton, Case Institute of Technology, Cleveland, on *"Gating and Risering;"* and W. E. Johnson, W. O. Baker and W. S. Pellini, Naval Research Laboratory, on *"Principles of Gating."*

Steel

In addition to the above-mentioned joint session Friday afternoon with the Gray Iron Division, the Steel Division's program includes technical sessions on May 10, 11 and 12, Steel Round Table Luncheon, and joint sessions with Gray Iron and Sand Division.

Opening Steel session the morning of May 10 will have three papers: *"Nature of Mold Cavity Gases,"* by Charles Locke, Armour Research Foundation, Chicago; *"Metal Penetrations in Steel Sand,"* by S. L. Gertsman, Canadian Bureau of Mines, Ottawa, Ont.; and *"Thermodynamic Study of Pinhole Formations in Steel Castings,"* by Howard F. Taylor, Massachusetts Institute of Technology, and R. E. Savage, International Nickel Co., New York.

May 11 session will have papers on *"Influence of Temperature on Fluidity and Surface Appearance of Steel Castings,"* by G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind.; and *"Steel Quality as Related to Test Bar Fractures,"* by H. H. Johnson and C. A. Fisher, National Malleable & Steel Castings Co., Sharon, Pa. Following this, at noon, May 11 will be the Steel Round Table Luncheon. Joint Sand and Steel symposium will be held that afternoon.

Friday's Steel program opens with a session featuring papers on *"Manganese Recovery in Acid Electric Steel Making,"* by S. F. Carter, American Cast Iron Pipe Co., Birmingham; and *"Metal Composition Tests for the Steel Melter,"* by H. H. Fairfield, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont. Afternoon session will have Howard F. Taylor, Massachusetts Institute of Technology, and R. E. Savage, International Nickel Co., New York, speaking on *"The Fayalite Reaction in Sand Molds Used for Steel Castings;"* and H. F. Bishop, Naval Research Laboratory, Washington, D. C., speaking on *"Relation of Thermal Gradients to the Soundness of Cast Steel Plates."* Concluding session will be held jointly with the Gray Iron Division.

Patterns

Opening the Pattern Division's program will be a session at 4:00 p.m. Tuesday, May 9, with Kurt A. Miericke, Baroid Sales Div., National Lead Co., Chicago, speaking on *"Making Pressure Cast Aluminum Matchplates in Plaster Molds";* R. F. Dalton of the United States Gypsum Co., Chicago, speaking on *"Production Patterns and the Matchplate";* and J. E. Wiss and R. B. Wagner, Perma-Flex Mold Co., Columbus, Ohio, speaking on *"Cold Formed Flexible Precision Patterns and Core Boxes."* Pattern Round Table Luncheon will be held Wednesday, May 10, with S. Zukor of the S. Greenfield Co., Buffalo, discussing *"An Alloy Designed for Pattern Shops."*

General Interest

Precision Investment Casting Session at 2:00 p.m., Monday, May 8, will feature *"Casting Aluminum in Moist Investment Molds,"* by Samuel Lipson and Hyman Rosenthal of Frankford Arsenal, Philadelphia; and *"Pattern Materials and Production in Precision Investment Casting,"* by E. I. Valyi, A.R.D. Corp.

Heat Transfer Session at 10:00 a.m., Tuesday, May 9, will have B. H. Alexander, Sylvania Electric Products, Inc., Bayside, L. I., N. Y., speaking on *"Solidification of Ingots;"* and V. Paschkis of Columbia University reporting on the Heat Transfer Research Project, *"Influence of Dry Sand Conductivity on Rate of Freezing of Steel Slabs."*

(Continued on Page 78)

Gold Medal AWARDS...

Honorary Life Membership

To Richard Schneidewind
The Wm. H. McFadden Gold Medal

"for his valuable contributions to the malleable iron industry in connection with the graphitization of white cast iron and for his many contributions to the Society and the castings industry"

Dr. Schneidewind's contributions to the advancement of the metal castings industry have been in the fields of research, education and consultation. Professor of metallurgical engineering at his alma mater, the University of Michigan, Dr. Schneidewind has long been active in the A.F.S. Educational Division, serving as chairman of the College Research Projects Committee and as a member of the Division's Executive and Textbook Committees. Also active in the A.F.S. Malleable Division, Dr. Schneidewind has conducted extensive research on malleable and gray irons and has presented the results of his findings before chapter, regional and national meetings of the Society.

To Clarence H. Lorig
The Joseph S. Seaman Gold Medal

"for many contributions to foundry metallurgy and for constant stimulation of research in the cast metals field"

Assistant director of Battelle Memorial Institute, Columbus, Ohio, Dr. Lorig has played an important role in advancing the foundry industry through participation in the work of A.F.S. and other metals societies, by performing and directing foundry research, and through the dissemination of information by numerous talks, some 50 technical papers, a book and five patents.
A past chairman of the A.F.S. Steel Division, Dr. Lorig is today active in that Division and the Gray Iron Division, and is a member of the A.F.S. Publications Committee.

To Ralph L. Lee
Honorary Life Membership

"for his philosophical approach to the problems of the foundry industry and for his stimulation of pride of craftsmanship among foundrymen."

Well-known to members of the American Foundrymen's Society for his frequent appearances at chapter meetings, regional foundry conferences and national conventions as a speaker on practical psychology of human relations and education, Dr. Lee is a member of the employee cooperation [illegible] of General Motors Corp., with which he has been asso[illegible]

To Clyde L. Frear
Honorary Life Membership

"for his long-time contributions to the Society and for his work in coordinating casting processes with Nav[illegible]

Senior materials engineer for the Bureau of S[illegible] has taught at Lehi[illegible] University and the U. S. Naval Academy at A[illegible] addition to holdi[illegible] executive metallurgical positions in industry. A [illegible] A.F.S. groups, Mr. Frear has also had many articles p[illegible] on castings and non-destructive inspection.

To Edwin W. Horlebein
Honorary Life Membership

"upon completion of his term as President of the American Foundrymen's Society"

A.F.S. National President Horlebein has during his term of office initiated plans for the formulation of policies for the future guidance of Directors, staff and committees of the Society, based on previously established policies viewed in the light of present day conditions and designed to permit longer range planning for the progress of the Society and the foundry industry. President Horlebein has also been active in visiting almost all chapters of A.F.S. during his term, as well as attending regional and national meetings of the Society.

Ladies

ENTERTAINMENT . . .

Mrs. Gilbert J. Nock
Vice-Chairman

HIGHLIGHTS OF CLEVELAND will be shown lady guests of the 54th A.F.S. Foundry Congress and Show, May 8 to 12. Included in four days of planned entertainment for ladies of the foundry world are an afternoon tea, a luncheon and style show, the A.F.S. Annual Banquet, and a sightseeing tour of Cleveland with luncheon overlooking Lake Erie.

Ladies' Entertainment program for the 54th Convention is under the chairmanship of Mrs. Frank G. Steinebach, with Mrs. Gilbert J. Nock as vice-chairman, and will open Monday afternoon, May 8, at 3:00 p.m. with a tea in the Ballroom of the Hotel Cleveland. Feature event of the afternoon will be a duo-piano recital by Thelma Merner Goldsword and Ruby Chavalier Carroll, noted Cleveland piano team. Mrs. Arthur J. Tuscany and Mrs. Fred J. Pfarr will act as hostesses for the tea.

Tuesday's program will feature a luncheon and style show at 1:00 p.m. in the Tenth Floor Auditorium of Cleveland's famed J. C. Higbee Co. department store. Latest trends in the world of feminine fashion will be shown. Hostesses for this event will be Mrs. F. Ray Fleig and Mrs. Thomas G. Johnston.

There is no program scheduled for the morning and afternoon of Wednesday, May 10, leaving the day open for movies, shopping or a chance to become acquainted with the many facilities Cleveland offers its visitors. In the evening, the Annual Banquet of the Society, top social event of the year, will feature as guest speaker Leonard E. Read, president of the Foundation for Economic Education.

Climaxing event of the Ladies' Entertainment program will be a tour of Cleveland and its suburbs starting at 11:00 a.m. from the Hotel Cleveland.

Traveling by specially-chartered sightseeing buses, ladies of the Convention will tour the East side of Cleveland, with its beautiful parks, art museum and cultural centers. Returning downtown along the Lake Shore, the tour will pass through the exclusive West Side residential district, ending at the Lake Shore Hotel, where luncheon will be served overlooking Lake Erie. A feature of the luncheon will be a book review by Miss Aileen Benninghoff. Buses will then return downtown. Cleveland Tour hostesses will be Mrs. Gilbert J. Nock and Mrs. John A. Sharritts.

Headquarters for Ladies' Registration will be maintained during convention week on the mezzanine floor of the Hotel Cleveland, with Mrs. James G. Goldie and Mrs. Lloyd W. Leeseburg in charge.

Wives of A.F.S. members will receive tickets for the week's events upon presentation of an official credential card to be issued each member. Registration fees for wives of non-members will be $5, and will include Monday, Tuesday and Thursday events.

LADIES' ENTERTAINMENT COMMITTEES

54th Annual Convention of the American Foundrymen's Society

Cleveland — **May 8-12**

Mrs. Frank G. Steinebach, Chairman — **Mrs. Gilbert J. Nock, Vice-Chairman**

REGISTRATION

Mrs. James C. Goldie, Chairman — **Mrs. Lloyd W. Leeseburg, Vice-Chairman**

TEA COMMITTEE

Mrs. Arthur J. Tuscany — **Mrs. Fred J. Pfarr**

LUNCHEON AND STYLE SHOW COMMITTEE

Mrs. F. Ray Fraug — **Mrs. Thomas G. Johnston**

CLEVELAND TOUR COMMITTEE

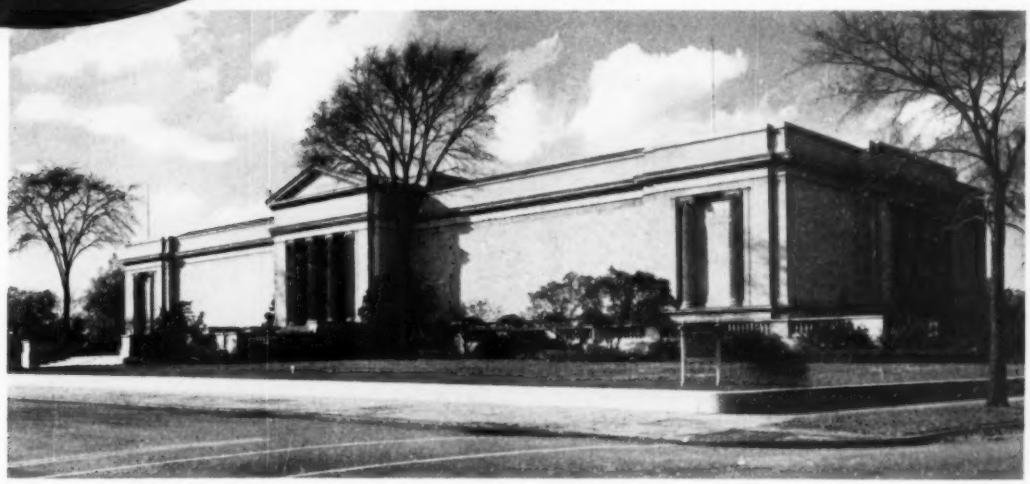
Mrs. Gilbert J. Nock — **Mrs. John A. Sharritts**

GENERAL COMMITTEE

Mrs. Gerald M. Cover	**Mrs. Lewis T. Crosby**
Mrs. Maurice V. Degley	**Mrs. A. C. Denison**
Mrs. Frank J. Dost	**Mrs. H. R. Doswell**
Mrs. Howard G. Gollehar	**Mrs. William G. Gude**
Mrs. Arthur J. Harlan	**Mrs. Howard E. Heyl**
Mrs. Bert G. Parker	**Mrs. Peter Rettig**
Mrs. Leroy P. Robinson	**Mrs. Leslie Schuman**
Mrs. Charles F. Steelbach, Jr.	**Mrs. Walter E. Sicha**
Mrs. J. H. Tresser	**Mrs. John M. Urban**

Mrs. Walton L. Woody

Cleveland's beautiful Museum of Art is a feature of Thursday afternoon's Tour.



Exchange Papers, Foreign Visitors

GIVE A.F.S. CONVENTION COSMOPOLITAN AIR

VISITORS FROM MANY LANDS, including 16-man delegations from Norway and England coming to study United States foundry production methods under the ECA program, will attend this year's A.F.S. Annual Convention and Foundry Show. The usual heavy attendance from Canada and Mexico, where there are A.F.S. chapters, is expected. In addition to the ECA group, England will be represented by the president of the Institute of British Foundrymen, N. P. Newman, managing director of Newman, Hender & Co. Ltd., Woodchester, who is a member of A.F.S., and other British foundrymen. This will be the first occasion

J. M. Laine

Frank Hudson

in nearly 30 years, according to IBF secretary Tom Makemson, that a president of the Institute has visited the A.F.S. Congress during his presidential year.

Other countries to be represented at this year's Convention include Belgium, Sweden, France, Switzerland, Cuba, and Ireland. As in the past, it is anticipated that foundrymen from Australia, China, India, Italy, Pakistan, Scotland, and a number of the South American countries will also be present.

Focal point for foreign visitors is the International Reception to be held in Parlors F, G, and H in the Statler Hotel, 4:30 p.m., Tuesday, May 9. Technical meetings with an international atmosphere include those at which the official exchange papers from the Institute of British Foundrymen and the Association Technique de Fonderie are presented. Papers and their authors are:

"Aluminum Alloy Castings — A Review of British Achievement," Frank Hudson, Mond Nickel Co., London, England — Official Exchange Paper from the Institute of British Foundrymen.

"Formation of Higher Technical Foundry Staffs in France," Jean Maurice Laine, Advanced Foundry School — Official Exchange Paper of the Association Technique de Fonderie.

Frank Hudson is in charge of the foundry section of the Development and Research Dept., Mond Nickel Co. Ltd. Educated at Rutherford College and Durham University, he entered the foundry industry as an apprentice in a firm now part of Vickers-Armstrong Ltd., and at 20 was named melting shop manager in one of the firm's iron foundries.

From 1925-27 he resided in the United States, being associated with American Brake Shoe in Chicago, Warren Foundry & Pipe Co., Phillipsburg, N. J., and Wyoming Shovel Works, Wyoming, Pa. Returning to England, Mr. Hudson became chief metallurgist with Glenfield & Kennedy Ltd., Kilmarnock, Scotland. He joined Mond Nickel in 1937 to look after nickel alloy casting production.

Mr. Hudson is an active member of IBF and the Institute of Metals, having headed the Scottish branch of both organizations. His more than 80 technical papers and lectures have been presented in Great Britain and abroad, and in 1936 he received the IBF Oliver Stubbs Gold Medal for his pioneer work on molding sands. He is active in committee work of IBF and other British societies, and was largely responsible for the publication of the Institute's *Atlas of Defects in Castings.*

Jean Maurice Laine, director of France's Advanced Foundry School, and vice-president of the Association Technique de Fonderie, has an extensive background of knowledge of the French foundry industry and the organization of its personnel. He holds diplomas designating him an engineer of arts and crafts and a graduate engineer of the Advanced Foundry School. He is also a civil engineer.

His affiliation with the School has been as engineer and as professor. Before assuming his present post with the Association Technique de Fonderie he was technical secretary, then general secretary. Mr. Laine has been research director at the Technical Center of the French Foundry Industries.

The Norwegian foundry productivity group, arriving in New York several days before the A.F.S. Convention starts in Cleveland, May 8-12, is headed by John L. Sissener, consulting engineer and chairman, Norwegian Foundrymen's Technical Society, Oslo. Not a stranger to United States foundries, he has written *10 Sections of the Modern Foundry Industry* based on his observations here in 1946, and in England, Sweden, Finland, Norway, and Denmark during 1946 and 1947. During a four month trip to the United States in 1946, Mr. Sissener visited the 50th A.F.S. Foundry Congress and 34 foundries.

Cross Section of Norway's Foundries

Other members of the Norwegian group are: Toroff E. Krogvig, Statens Teknologiske Institutt, Oslo, Ragnar Brynildsbakken, A/S Strommens Vaerksted, Strommen; Karl Stenstadvold, Foss Jernstoperi, Oslo; Harry T. Karlberg and Ivar E. Larsen, A/S Myrens Verksted, Oslo; Ragnar Astad and Tonnes Tollefsen, A/S Sandnes Stoperi, Sandnes; Knut Tron-

stad, Einar Johnsen and Ragnar H. Olsen, Jotul og Kvaerner Ovnstoperi A/S, Oslo; Torkel Serigstad, Serigstad Maskinverksted, Jaeren; Gunnar Myhrvold, A/S Hamar Jernstopori & Mek. Verksted, Hamar; and Oddleiv Kristiansen, Raufoss Ammunisjonsfabrikker, Raufoss.

Personnel of the English team visiting United States foundries from April 26 to June 6 has not been established. Group members are coming to study nonferrous foundry production, machining, assembling, and electroplating of valves, fittings, and building hardware.

Information from the Convention Housing Bureau received as this is written indicates that Convention attendants will include:

Robert Ronceray of Ph. Bonvillain & E. Ronceray, Choisy Le Roi, France, a frequent foreign visitor at A.F.S. Foundry Shows.

Kenneth Marshall, director of the Joint Iron Council, London; Henry J. Bullock and V. L. Cashmore, British Moulding Machine Co., Faversham; and E. Allison, W. R. Cooper, and N. Croft, Lloyd's (Burton) Ltd., Burton on Trent, England.

E. Buehrer and W. Goetz, George Fischer Ltd., Schaffhausen; and Karl Baenninger, Sr., and Karl Baenninger, Jr., Baenninger Malleable Fitting Works, Zurich, Switzerland.

Thomas Lewander, Civilingenjor Hugo Montgomery AB, Stockholm; and Ake Johnson, Johnson-Werken, Orebro, Sweden.

Jacques De Vos, Societe Belge Griffin, Merksem-lez-Anvers, Belgium.

Ildefonso Quesada, Jr., and Ildefonso Quesada Lopez-Chavez, Lamparas Quesada, S.A., Havana, Cuba.

Canada and Mexico Well Represented

Frequent Convention attendants who will swell the group from Mexico this year are: Delbert G. Luper, Iturbe y Zalce, Tacubaya; N. S. Covacevich, La Consolidada S.A., Mexico City; Hrbano Lopez Ayala, Teziutlan Copper Co., Aire Libre Pus; and Luis Delgado Vega, Casco S. de R.L., Mexico City.

Leading a huge delegation from Canada, which each year is an important part of A.F.S. Convention attendance, are National Director E. N. Delahunt, Warden King, Ltd., Montreal, Que., and Director-Nominee J. J. McFadyen, Galt Malleable Iron Co., Galt, Ont.

IBF Conference to Hear A.F.S. Paper

The American Foundrymen's Society's part in this year's exchange of papers with the Institute of British Foundrymen is being taken by Hiram Brown, Solar Aircraft Co., Des Moines, Iowa, who has prepared a paper entitled *"Non-Ferrous Investment Casting."* Presentation will occur during the IBF Annual Conference in Buxton, June 6-9. The 1950 exchange is the 29th between the two foundry organizations.

Hiram Brown

Mr Brown's paper is one of some 16 papers and technical committee reports to be presented during the 47th Annual Conference of IBF. Technical highlight will be the Edward Williams Lecture, with Sir Andrew McCance speaking on *"Gases and Steel."* This will follow the address of President-Designate J. J. Sheehan during the IBF annual general meeting.

Hiram Brown, a graduate of Penn College, is chief metallurgist for Solar Aircraft Co., and has wide experience in sand, permanent mold, die, and precision investment casting. Author of a number of technical papers, he also has written a book, *Aluminum and Its Applications,* and has participated in a number of A.F.S. Conventions.

Mr. Brown is vice-chairman of the A.F.S. Aluminum and Magnesium Division and chairman of that division's Program and Papers Committee.

Scheduled too early to include the A.F.S. Foundry Congress and Show was the visit of a 15-man iron foundry productivity team from England. Shown is part of the group in the Chicago plant of Crane Co., one of 16 visited during a six-week, six-state tour sponsored by the ECA. Leader of the team, Samuel Russell, said members of the group were hoping to "educate managements in many ways" on their return to Britain. They had been received everywhere with friendliness and hospitality; in the field of semi-mass production valuable lessons had been learned, he declared. One team member estimated that a method observed during his visit would increase production in Britain by 30 per cent at little cost.

54

A.F.S.

HOYT, LECTURER — BANQUET SPEAKER

W. W. Levi

OUTSTANDING FIGURES in their respective fields—metallurgy and economics—have been selected to present the two highlight addresses of the 54th Annual Foundry Congress and Exhibit of the American Foundryman's Society next month in Cleveland.

Selected to deliver the Charles Edgar Hoyt Annual Lecture, one of the highest honors conferred by the Society, is W. W. Levi, chief metallurgist of the Lynchburg Foundry Co., Lynchburg, Va.

Annual Banquet Speaker this year will be Leonard E. Reed, president of the Foundation for Economic Education, Inc., Irvington-on-Hudson, N. Y., long distinguished in economic affairs of the nation.

Hoyt Lecture on Cupola Operation

Mr. Levi, who will speak on *"Operation of the Cupola"* at 4:00 p.m., Wednesday, May 10, following the Annual Business Meeting of the American Foundrymen's Society, has for many years been active in metallurgical research and in technical work of the Society. He has spoken before many chapters, regional and national meetings of A.F.S.

Born December 22, 1902, in Ann Arbor, Mich., the son of a professor of French at the University of Michigan, Mr. Levi attended high school in that city and later majored in Metallurgical Engineering at the University of Michigan, where he was a member of Tau Beta Pi, honorary engineering fraternity. During this period, in 1922 and 1923, Mr. Levi travelled in France, Italy and Switzerland, attending the Special School of Public Works in Paris for six months between his Continental travels.

Began Foundry Career in 1926

Mr. Levi began his foundry career in 1926 as an apprentice with the Union Malleable Iron Co. of Moline, Ill., proving so capable and willing a worker that within eight months he was appointed foreman of the company's annealing department.

From there, he moved to the heat treating department of John Deere Harvester Works, East Moline, Ill., in 1927, leaving two years later to become a member of the laboratory staff of Deere & Co. in Moline. In 1930, Mr. Levi was named foundry metallurgist for the John Deere Tractor Co., Waterloo, Iowa.

It was during this period with the John Deere Tractor Co. that Mr. Levi met A.F.S. National Past President Max Kuniansky, general manager of the Lynch-

Leonard E. Read

burg Foundry Co., at an A.F.S. Convention. Mutual respect for each other's technical capabilities led Mr. Kuniansky to offer Mr. Levi a position with Lynchburg Foundry Co. as metallurgist in 1934. Mr. Levi is today chief metallurgist for the Radford, Va., plant of the Lynchburg Foundry Co.

Prominent In A.F.S. Activities

For many years prominent in technical affairs of the American Foundrymen's Society, Mr. Levi is vice-chairman of the A.F.S. Gray Iron Division; chairman of that Division's Program and Papers Committee; vice-chairman of its Section Size Relationships Committee; and a member of the Gray Iron Test Bar Design, Shop Operation Course, and Chill Test Committees, and of the A.F.S. Fluidity Testing Committee.

Mr. Levi's frequent appearances before national meetings of the American Foundrymen's Society have included presentation of papers on gating of heavy castings, cupola operation and control, and carbon control in the cupola. Two years ago, Mr. Levi toured the five A.F.S. West Coast chapters, speaking on the latter subject.

Mr. Levi is the author of *"Cupola Operation and Control,"* (AMERICAN FOUNDRYMAN, February, 1946) and *"Carbon Control in the Cupola,"* (AMERICAN FOUNDRYMAN, October, 1947). In addition to his many activities in the American Foundrymen's Society, Mr. Levi holds memberships in the American Society for Metals and the American Society for Testing Materials, of which he is a member of the Test Bar, Section Size and A-3 Committees.

Hoyt Lectureship An Honor

One of the highest honors conferred by the American Foundrymen's Society, the Charles Edgar Hoyt Annual Lecture is the highlight of the technical program of the 1950 A.F.S. Foundry Congress & Show. The Annual Lecture had its inception in 1938, when Charles R. Hook, president of the National Association of Manufacturers, delivered what was then known as the Awards Lecture. In 1943, the title of this lecture was changed to the Foundation Lecture, and again in 1946, the name was changed to the Charles Edgar Hoyt Annual Lecture in honor of the retired executive vice-president of the Society. Mr. Levi's name will be an addition to this already distinguished roster of Annual Lecturers, which reads like a "Who's Who" of American industry.

To Speak on Economic Liberty

Leonard E. Read, who will speak at the Annual Banquet of the American Foundrymen's Society Wednesday evening, May 10, will climax the highlight foundry social event of the Convention with a talk on *"Students of Liberty."*

Well qualified to speak on the subject of liberty is Mr. Read, who heads an organization dedicated to the fight against collectivism and those other "isms" opposed to the freedom of individual thought and enterprise that is an American heritage. President of the Foundation for Economic Education, Mr. Read has dedicated his life and work to opposing State control of means of production.

Heads Economic Foundation

The Foundation for Economic Education is a non-political research and educational institution, incorporated under the laws of New York in 1946. Responsible to no outside persons or groups, the Foundation, under Mr. Read's direction, uncovers and disseminates factual data on economics, political science and related subjects. The staff of this organization is composed of skilled economists, writers, statisticians and others accomplished in liberal philosophy. The work of the staff and of contributing authors of the Foundation for Economic Education is made available to the public through publication of books, pamphlets and editorial material supplied to the nation's press and other public relations media.

Mr. Read himself is the author of two brochures published by the Foundation—*"On That Day Began Lies,"* an analysis of the danger of permitting organizations to speak for their members—and *"The Penalty of Surrender,"* an examination of compromise and the "middle way."

Headed Los Angeles C. of C.

Mr. Read began his economic fight in 1929 as assistant manager of the Western Division of the United States Chamber of Commerce, and three years later was appointed manager of the Division. In 1939, Mr. Read was made general manager of the Los Angeles Chamber of Commerce, an organization whose legendary exploits in publicizing that California city have been instrumental in its phenomenal growth.

In 1945, Mr. Read was appointed executive vice-president of the National Industrial Conference Board, and in 1946, was named head of the newly-created Foundation for Economic Education, Inc., at Irvington-on-Hudson, N. Y.

Mr. Read's address before the 1950 Annual Banquet of the American Foundrymen's Society, on the strength of his nationally-known talents as a speaker, promises to make this year's Annual Banquet a memorable one, climaxing the highlight affair of the 54th Annual Foundry Congress and Show.

AFS 54

Convention Program

AND PROGRAM PERSONALITIES

MONDAY, MAY 8

10:00 AM—Registration Begins
Exhibits Open

10:00 AM (A)—Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—R. F. Thomson, International Nickel Co., Detroit.

Co-Chairman—C. E. Nelson, Dow Chemical Co., Midland, Mich.

"Fluid Flow in Transparent Molds"—Motion Picture, A.F.S. Sponsored Aluminum and Magnesium Research Project—L. W. Eastwood, Battelle Memorial Institute, Columbus, Ohio.

10:00 AM (B)—Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—J. J. Curran, Walworth Co., Greensburg, Pa.

Co-Chairman—R. W. Thomas, Waukesha Foundry Co., Waukesha, Wis.

"An Investigation of Melting and Casting Procedures

H. W. Lownie

C. H. Wyman

V. A. Crosby

F. W. Shipley

F. S. Brewster

A. P. Gagnebin

MONDAY, MAY 8 (Cont'd)

for High Purity Nickel"—D. W. Grobecker, Los Alamos Scientific Laboratory, Los Alamos, N. M.

"*Metal Melting—Application of Thermodynamic Principles to Melting Nonferrous Metals*"—R. I. Moore, Wilson Brass and Aluminum Foundry Co., Toronto, Ont., Canada.

10:00 AM (C)—Malleable Session

(Sponsored by Malleable Division)

Presiding—H. C. Stone, Belle City Malleable Iron Co., Racine, Wis.

Co-Chairman—E. Roby, Jr., Peoria Malleable Co., Peoria, Ill.

"*Some Effects of Deoxidizing Additions on Malleable Iron*"—R. W. Heine, University of Wisconsin.

"*Subcritical Isothermal Graphitization*"—H. A. Schwartz, National Malleable and Steel Castings Co., Cleveland.

12:00 Noon—Aluminum and Magnesium Round Table Luncheon

(Sponsored by Aluminum and Magnesium Division)

Presiding—Walter Bonsack, Christiansen Corp., Chicago.

Co-Chairman—H. J. Rowe, Aluminum Company of America, Pittsburgh.

Subject—"*Test Bar Gating.*"

MAY 8 to 12 • 1950

1:00 PM to 9:30 PM—NORTHEASTERN OHIO DAY—Free Admission for Local Plant Men

2:00 PM (A)—Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—G. J. Barker, University of Wisconsin.

Co-Chairman—J. W. Bolton, Lunkenheimer Co., Cincinnati.

"*Effect of Superheat and Casting Temperature on Properties of Tin Bronze*"—B. N. Ames and N. A. Kahn, New York Naval Shipyard, Brooklyn.

"*Melt Quality and Fracture Characteristics of 85-5-5-5*"—A.F.S. Sponsored Brass and Bronze Research Project—F. B. Rote, University of Michigan, Ann Arbor.

2:00 PM (B) Malleable Session

(Sponsored by Malleable Division)

Presiding—F. Jacobs, Lake City Malleable Iron Co., Ashtabula, Ohio.

Co-Chairman—E. C. Zirzow, Deere & Co., Moline, Ill.

"*Furnace Atmosphere for Malleable Annealing*"—W. D. McMillan, International Harvester Co., Chicago.

"*Surface Hardening of Pearlitic Malleable Iron*"—A.F.S.-Sponsored Malleable Research Project—S. H. Bush, W. P. Wood and F. B. Rote, University of Michigan, Ann Arbor.

2:00 PM (C)—Precision Investment Casting Session

(Sponsored by Precision Investment Casting Committee)

Presiding—L. E. Grubb, International Nickel Co., Bayonne, N. J.

Co-Chairman—T. E. Moore, Ransom & Randolph Co., Toledo, Ohio.

"*Casting Aluminum in Moist Investment Molds*"—S. Lipson and H. Rosenthal, Frankford Arsenal, Philadelphia.

"*Pattern Materials and Production in Precision Investment Casting*"—E. I. Valyi, A. R. D. Corp., New York.

W. E. Carver

H. Rosenthal

S. F. Carter

R. H. Olmstead

H. F. Taylor

B. L. Bevis

T. E. Moore

R. A. Flinn

R. C. Wood

H. C. Stone

T. W. Curry

J. H. Lansing

AFS 54 Program

7:00 PM—Chapter Officers and Directors Dinner

Presiding—E. W. Horlebein, President, American Foundrymen's Society.

8:00 PM (A)—Gray Iron Shop Course

(Sponsored by Gray Iron Shop Course Committee)

Presiding—K. H. Priestley, Vassar Electroloy Products, Inc. Vassar, Mich.

Co-Chairman—E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.

Subject *"Pouring Practice for Gray Iron."*

Discussion Leader—E. W. Deutschlander, Worthington Pump Co., Depew, N. Y.

H. H. Kessler

G. E. Garvey

A. E. Schuh

C. B. Jenni

E. Deutschlander

R. Schneidewind

C. W. Briggs

J. W. Meier

J. B. Caine

S. F. Krzeszewski

F. B. Rote

Walter Bonsack

MONDAY, MAY 8 (Cont'd)

4:00 PM (A)—Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—M. E. Brooks, Dow Chemical Co., Bay City, Mich.

Co-Chairman—E. J. Vargo, Wellman Bronze & Aluminum Co., Cleveland.

"Magnesium Foundry Practice in Canada"—M. W. Martinson and J. W. Meier, Bureau of Mines, Ottawa, Ont., Canada.

"Equipment for Degassing Magnesium Alloy Melts"—A. J. Juroff, Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.

5:30 PM—Registration Closes

6:30 PM—Non-Ferrous (Son-Father) Dinner

(Sponsored by Non-Ferrous Founders' Society)

H. Bornstein

R. W. Gardner

H. N. Bogart

R. B. Melmoth

K. A. Miericke

W. E. George

MONDAY, MAY 8 (Cont'd)

8:00 PM (B)—Non-Ferrous Shop Course

(Sponsored by Brass and Bronze Division)

Presiding—J. L. Stroman, Stroman Furnace & Engineering Co., Franklin Park, Ill.

Subject—*"Fuel-Fired Furnace Practice."*

Discussion Leader—M. G. Dietl, Crane Co., Chicago.

8:00 PM (C)—Sand Shop Course

(Sponsored by Sand Shop Course Committee)

Presiding—F. S. Brewster, Harry W. Dietert Co., Detroit.

Co-Chairman—E. L. Thomas, Packard Motor Car Co., Detroit.

Subject—*"Core and Mold Blowing."*

Discussion Panel—A. E. Czechowicz, Key Co., E. St. Louis, Ill.; R. W. Gardner, Ford Motor Co., Dearborn, Mich.; L. D. Pridmore, International Molding Machine Co., LaGrange Park, Ill.

9:30 PM—Exhibits Close

TUESDAY, MAY 9

9:00 AM—Registration Opens Exhibits Open

10:00 AM (A)—Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—R. E. Ward, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.

Co-Chairman—W. E. Carver, Light Metals, Inc., Indianapolis, Ind.

"New Aluminum-Zinc-Magnesium-Copper Casting Alloys"—W. E. Sicha and H. Y. Hunsicker, Aluminum Co. of America, Cleveland.

"Corrosion and Stress-Corrosion Properties of a High Strength Aluminum-Zinc-Magnesium-Copper Castings Alloy"—R. A. Quadt and E. C. Reichard, Federated Metals Div., American Smelting & Refining Co., Barber, N. J.

10:00 AM (B)—Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—W. Romanoff, H. Kramer & Co., Chicago.

Co-Chairman—H. Brown, Solar Aircraft Co., Des Moines, Iowa.

"Metal Specifications for Brass and Bronze Foundry"—J. G. Dick, Canadian Bronze Co., Ltd., Montreal, Que., Canada.

"Aluminum Additions in Commercial Yellow Brass"—R. A. Colton and R. H. Gilbert, Federated Metals Div., American Smelting & Refining Co., Barber, N. J.

10:00 AM (C)—Heat Transfer Session

(Sponsored by Heat Transfer Committee)

Presiding—H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

Co-Chairman—E. C. Troy, Foundry Engineer, Palmyra, N. J.

"Solidification of Ingots"—B. H. Alexander, Sylvania Electric Products, Inc., Bayside, N. Y.

"Influence of Dry Sand Conductivity on Rate of Freezing of Steel Slabs"—A.F.S.-Sponsored Heat Transfer Research, V. Paschkis, Columbia University.

10:00 AM (D)—Malleable Session

(Sponsored by Malleable Division)

Presiding—H. Hunt, Auto Specialties Mfg. Co., St. Joseph, Mich.

Co-Chairman—F. Wurscher, Marion Malleable Iron Co., Marion, Ind.

"Inspection of Pearlitic Malleable Castings"—D. T. Martin, Saginaw Malleable Iron Plant Div., GMC, Saginaw, Mich.

"Quantitative Correlation of Factors Influencing Annealing"—R. Schneidewind, University of Michigan.

G. A. Fisher

O. J. Myers

B. H. Booth

G. Vennerholm

M. T. Sell

H. A. Schwartz

H. L. Smith

P. E. Rentschler

H. G. Sieggreen

James Thomson

S. L. Gertsman

C. C. Sigerfoos

TUESDAY, MAY 9 (Cont'd)

12:00 Noon (A)—Malleable Round Table Luncheon

(Sponsored by Malleable Division)

Presiding—J. H. Lansing, Malleable Founders' Society, Cleveland.

Co-Chairman—C. V. Lauenstein, Link-Belt Co., Indianapolis, Ind.

Subjects—*"Effect of Excessive Oxidation in Duplex Melting"* and *"Design of Dies for Straightening."*

Discussion Panel—Milton Tilley, National Malleable & Steel Castings Company, Cleveland; H. C. Stone, Belle City Malleable Iron Co., Racine, Wis.; H. G. Sieggreen, Central Foundry Div., GMC, Saginaw, Mich.; and K. L. Sanders, Albion Malleable Iron Co., Albion, Mich.

12:00 Noon (B)—Brass and Bronze Round Table Luncheon

(Sponsored by Brass and Bronze Division)

Presiding—B. A. Miller, Baldwin Locomotive Works, Philadelphia.

Co-Chairman—H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh.

Subject—*"Casting Defects."*

Discussion Leader—H. F. Taylor, Massachusetts Institute of Technology, Cambridge.

2:00 PM (A)—Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—S. C. Massari, American Foundrymen's Society, Chicago.

Co-Chairman—H. Brown, Solar Aircraft Co., Des Moines, Iowa.

"Aluminum Alloy Castings—A Review of British Achievement"—Frank Hudson, Mond Nickel Co., London, England. OFFICIAL EXCHANGE PAPER FROM INSTITUTE OF BRITISH FOUNDRYMEN.

2:00 PM (B)—Sand Session

(Sponsored by Sand Division)

Presiding—H. K. Salzberg, Borden Co., Bainbridge, N. Y.

Co-Chairman—E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit.

"Treatment of Bond Clays for Foundry Sand"—A. E. Pavlish (formerly with Battelle Memorial Institute, Columbus), Kelly Island Lime and Transport Co., Cleveland—(To be presented by H. W. Lownie, Battelle Memorial Institute.)

"Phenolic Resin Core Binders—Effect of Core Mix on Physical Properties"—J. E. McMillan and J. A. Wickett, Monsanto Chemical Co., Springfield, Mass.

William Romanoff

E. G. Tetzlaff

H. H. Wilder

J. A. Rassenfoss

R. A. Quadt

P. E. Kyle

W. H. Ruten

W. H. Moore

R. E. Kerr

J. E. Rehder

N. J. Stickney

R. F. Dalton

TUESDAY, MAY 9 (Cont'd)

4:00 PM (A)—Pattern Session

(Sponsored by Pattern Dvision)

Presiding—J. Mathias, Accurate Matchplate Co., Chicago.

Co-Chairman—A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.

"Making Pressure Cast Aluminum Match Plates in Plaster Molds"—K. A. Miericke, Baroid Sales Div., National Lead Co., Chicago.

"Production Patterns and the Matchplate"—R. F. Dalton, U. S. Gypsum Co., Chicago.

"Cold Formed Flexible Precision Patterns and Core Boxes"—J. E. Wiss and R. B. Wagner, Perma-Flex Mold Co., Columbus Ohio.

4:00 PM (B)—Educational Session

(Sponsored by Educational Division)

Presiding—A. W. Gregg, Whiting Corp., Harvey, Ill.

Co-Chairman—W. H. Ruten, Brooklyn Polytechnic Institute, Brooklyn.

Round Table Discussion—*"High School and Trade School Training."*

Discussion Panel—W. J. MacNeill, Dayton Malleable Iron Co., Dayton, Ohio; Jas. H. Smith, Central Foundry Div., GMC, Saginaw, Mich.; P. E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio.

4:00 PM (C)—Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—R. T. Wood, American Magnesium Corp., Cleveland.

Co-Chairman—J. C. McDonald, Dow Chemical Co., Midland, Mich.

"Casting of Magnesium-Rare Earth-Zirconium Alloys in Sand"—K. E. Nelson and F. P. Strieter, Dow Chemical Co., Midland, Mich.

"Development of High-Strength Magnesium Casting Alloy ZK61"—J. W. Meier and M. W. Martinson, Bureau of Mines, Ottawa, Ont., Canada.

4:30 PM—International Reception

5:30 PM—Registration Closes Exhibits Close

7:00 PM (A)—Canadian Dinner

Presiding—E. N. Delahunt, Warden King, Ltd., Montreal, Que., Canada.

Co-Chairman—J. J. McFadyen, Galt Malleable Iron Co., Galt, Ont., Canada.

7:00 PM (B)—Educational Dinner

(Sponsored by Educational Division)

Presiding—B. D. Claffey, Acme Aluminum Alloys, Inc., Dayton, Ohio.

Co-Chairman—G. K. Dreher, Foundry Educational Foundation, Cleveland.

"Foundry Apprentice Training at Caterpillar Tractor Co"—F. W. Shipley and B. L. Bevis, Caterpillar Tractor Co., Peoria, Ill.

"The Engineering Student and Summer Foundry Works"—N. J. Stickney, University of Wisconsin, Madison.

8:00 PM (A)—Gray Iron Shop Course

(Sponsored by Gray Iron Shop Course Committee)

Presiding—L. L. Clark, Buick Motor Div., GMC, Flint, Mich.

Co-Chairman—E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.

Subject—*"Cupola Bed Practice."*

Discussion Leader—B. P. Mulcahy, Consultant, Indianapolis, Ind.

R. G. McElwee

M. Tilley

G. K. Dreher

E. C. Zirzow

A. F. Pfeiffer

A. W. Gregg

Charles Locke

B. P. Mulcahy

A. E. Czechowicz

F. J. Walls

E. J. Vargo

H. H. Johnson

A.F.S. 54 Program

TUESDAY, MAY 9 (Cont'd)

8:00 PM (B)—Non-Ferrous Shop Course

(Sponsored by Brass and Bronze Division)

Presiding—B. W. Schafer, Kuhlman Electric Co., Bay City, Mich.

Subject—*"Electric Furnace Melting."*

Discussion Leader—M. G. Dietl, Crane Co., Chicago.

8:00 PM (C)—Sand Shop Course

(Sponsored by Sand Shop Course Committee)

Presiding—E. J. Bush, U. S. Naval Gun Factory, Washington, D. C.

Co-Chairman—R. H. Olmstead, Whitehead Bros. Co., New York.

Subject—*"Core Dip Test."*

Discussion Leader—J. B. Caine, Consultant, Wyoming, Ohio.

WEDNESDAY, MAY 10

9:00 AM—Registration Opens Exhibits Open

10:00 AM (A)—Sand Session

(Sponsored by Sand Division)

Presiding—C. B. Jenni, General Steel Castings Corp., Eddystone, Pa.

Co-Chairman—J. H. Lowe, Wehr Steel Co., Milwaukee.

"Reproductibility of Foundry Sand Tests"—B. H. Booth, Carpenter Bros., Inc., Milwaukee; P. C. Rosenthal, University of Wisconsin, Madison; and H. W. Dietert, Harry W. Dietert Co., Detroit.

"Properties of Steel Sands at Elevated Temperatures"—A.F.S. Sponsored Sand Research Project,—R. G. Thorpe and P. E. Kyle, Cornell University, Ithaca.

10:00 AM (B)—Refractories Session

(Sponsored by Refractories Committee)

Presiding—A. S. Klopf, Western Foundry Co., Chicago.

Co-Chairman—R. H. Stone, Vesuvius Crucible Co., Pittsburgh.

"Refractory Practice in Melting of Acid Electric Steel"—R. H. Jacoby and M. Petty, Key Co., East St. Louis, Ill.

10:00 AM (C)—Joint Gray Iron and Malleable Session

(Jointly Sponsored by Gray Iron and Malleable Divisions)

Presiding—H. Bornstein, Deere & Co., Moline, Ill.

Co-Chairman—T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.

"Problems in Producing Ductile Iron"—Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

"An Introduction to the Annealing of Nodular Iron" J. E. Rehder, Bureau of Mines, Ottawa, Ont., Canada.

10:00 AM (D)—Steel Session

(Sponsored by Steel Division)

Presiding—C. W. Briggs, Steel Founders' Society of America, Cleveland.

Co-Chairman—R. E. Kerr, Pettibone Mulliken Corp., Chicago.

"Nature of Mold Cavity Gases"—Charles Locke, Armour Research Foundation, Chicago.

"Metal Penetrations in Steel Sand"—S. L. Gertsman, Bureau of Mines, Ottawa, Ont., Canada.

"Thermodynamic Study of Pinhole Formation in Steel Castings"—H. F. Taylor, Massachusetts Institute of Technology, Cambridge, and R. E. Savage, International Nickel Co., New York.

K. H. Priestley

R. J. Wolf

Max Kuniansky

B. D. Claffey

G. E. Bellew

F. J. Wurscher

WEDNESDAY, MAY 10 (Cont'd)

12:00 Noon (A)—Gray Iron Round Table Luncheon

(Sponsored by Gray Iron Division)

Presiding—F. S. Brewster, Harry W. Dietert Co., Detroit.

Co-Chairman—R. A. Clark, Electro Metallurgical Div., Union Carbide & Carbon Corp., Chicago.

Subject—*"The Effect of Mold Materials on Metal Shrinkage."*

Discussion Leader—C. C. Sigerfoos, Michigan State College, East Lansing.

12:00 Noon (B)—Pattern Round Table Luncheon

(Sponsored by Pattern Division)

Presiding—G. Garvey, City Pattern & Foundry Co., South Bend, Ind.

Co-Chairman—H. C. Swanson, Arrow Pattern & Fdry. Co., Chicago.

Subject—*"An Alloy Designed for Pattern Shops."*

Discussion Leader—S. Zukor, S. Greenfield Co., Buffalo, N. Y.

3:00 PM—ANNUAL BUSINESS MEETING EXHIBITS CLOSE

Presiding—E. W. Horlebein, President, American Foundrymen's Society.

PRESIDENT'S ANNUAL ADDRESS.
APPRENTICE CONTEST AWARDS.
ELECTION OF OFFICERS AND DIRECTORS.

4:00 PM—CHARLES EDGAR HOYT ANNUAL LECTURE

"Operation of the Cupola"—W. W. Levi, Lynchburg Foundry Co., Radford, Va.

R. A. Clark

R. P. Schauss

J. A. Wagner

R. W. Thomas

R. E. Ward

K. E. Nelson

7:00 PM—ANNUAL BANQUET

Presiding—E. W. Horlebein, President, American Foundrymen's Society.

PRESENTATION OF A.F.S. GOLD MEDAL AWARDS AND HONORARY LIFE MEMBERSHIPS.

Speaker—Leonard E. Read, President, Foundation for Economic Education, Irvington-on-the-Hudson, New York.

Subject—*"Students of Liberty."*

THURSDAY, MAY 11

8:00 AM—A.F.S. Past Presidents' Breakfast

9:00 AM—Registration Opens Exhibits Open

10:00 AM (A)—Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—A. P. Gagnebin, International Nickel Co., Bayonne, N. J.

Co-Chairman—W. B. McFerrin, Haynes Stellite Div., Union Carbide Corp., Kokomo, Ind.

"Improved Test Bars for Standard and Ductile Grades of Cast Iron"—R. A. Flinn and R. W. Kraft, American Brake Shoe Co., Mahwah, N. J.

"Cupola Research"—A.F.S.-SPONSORED RESEARCH—R. G. McElwee, Vanadium Corp. of America, Detroit.

10:00 AM (B)—Management Functions and Controls Session

(Jointly Sponsored by Foundry Cost Committee and Time Study and Methods Committee)

Presiding—R. L. Lee, Grede Foundries, Inc., Milwaukee.

Co-Chairman—V. E. Zang, Unitcast Corp., Toledo, Ohio.

"Administration of Wage Incentives"—C. T. Hassell, Lester B. Knight and Associates, Chicago.

"Organizing Management for Profit"—W. E. George, Booz, Allen and Hamilton, Chicago.

10:00 AM (C)—Sand Session

(Sponsored by Sand Division)

Presiding—Bradley H. Booth, Carpenter Bros., Inc., Milwaukee.

Co-Chairman—J. O. Ochsner, Crouse-Hinds Co., Syracuse, N. Y.

"Flowability of Molding Sands" W. H. Moore, Meehanite Metals Corp., South Euclid, Ohio.

"Factors Affecting Molding Sand Density, Shrinkage and Workability"—R. P. Schauss and R. F. Baley, Illinois Clay Products Co., Chicago, and E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit.

10:00 AM (D)—Steel Session

(Sponsored by Steel Division)

Presiding—R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis.

Co-Chairman—F. O. Lemmon, Ohio Steel Foundry Co., Springfield, Ohio.

"Influence of Temperature on Fluidity and Surface

THURSDAY, MAY 11 (Cont'd)

Appearance of Steel Castings"—G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind.

"*Steel Quality as Related to Test Bar Fractures*"—H. H. Johnson and C. A. Fisher, National Malleable & Steel Castings Co., Sharon, Pa.

12:00 Noon—Steel Round Table Luncheon

(Sponsored by Steel Division)

Presiding—V. E. Zang, Unitcast Corp., Toledo, Ohio.

Co-Chairman—R. E. Kerr, Pettibone Mulliken Corp., Chicago.

Subjects—"*Fluidity Tests in Relation to Temperature and Temperature Control*," "*Steel Temperature Measurements*," and "*Casting Surface Finish and Defects.*"

2:00 PM (A)—Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—A. E. Schuh, United States Pipe & Foundry Co., Burlington, N. J.

Co-Chairman—C. K. Donoho, American Cast Pipe Co., Birmingham, Ala.

"*Composition and Properties of Gray Iron*"—R. Schneidewind, University of Michigan, Ann Arbor, and R. G. McElwee, Vanadium Corp. of America, Detroit.

"*Basic Lined Cupola*"—S. F. Carter, American Cast Iron Pipe Co., Birmingham, Ala.

2:00 PM (B)—Timestudy and Methods Session

(Sponsored by Time Study and Methods Committee)

Presiding—E. G. Tetzlaff, Pelton Steel Casting Co., Milwaukee.

Co-Chairman—M. T. Sell, Sterling Foundry Co., Wellington, Ohio.

"*Standard Data for Bench Coremaking*"—R. H. Williams, Williams Management Engineering Co., Milwaukee.

"*Fatigue Data Survey*"—M. E. Annich, American Brake Shoe Co., Mahwah, N. J.

4:00 PM (A)—Foundry Cost Session

(Sponsored by Foundry Cost Committee)

Presiding—R. L. Lee, Grede Foundries, Inc., Milwaukee.

Co-Chairman—George Tisdale, Zenith Foundry Co., Milwaukee.

"*Management Views Costs*"—J. A. Wagner, Wagner Malleable Iron Co., Decatur, Ill.

4:00 PM (B)—Plant and Plant Equipment Session

(Sponsored by Plant and Plant Equipment Committee)

Presiding—James Thomson, Continental Foundry & Machine Co., East Chicago, Ind.

Co-Chairman—R. J. Wolf, Stone & Webster Engineering Corp., Boston.

"*Oxygen Cutting Processes in Steel Foundries*"—R. Babcock, Linde Air Products Co., Newark, N. J.

"*Bandsawing in Foundries*"—G. H. Sheppard, DoALL Co., Des Plaines, Ill.

"*Selection and Application of Cleaning Equipment*"—S. F. Krzeszewski, American Wheelabrator & Equipment Co., Mishawaka, Ind.

4:00 PM (C)—Joint Sand and Steel Symposium

(Jointly Sponsored by Sand and Steel Divisions)

Presiding—Charles Locke, Armour Research Foundation, Chicago.

Co-Chairman—C. B. Jenni, General Steel Castings Corp., Eddystone, Pa.

Subject—"*Interpretation of Sand Tests as Related to Steel Castings.*"

Introduction—E. C. Troy, Foundry Engineer, Palmyra, N. J.

Room Temperature Testing—J. H. Lowe, Wehr Steel Co., Milwaukee, and C. Wyman, Burnside Steel Foundry Co., Chicago.

High Temperature Testing—P. E. Kyle, Cornell University, Ithaca, N. Y.; R. H. Jacoby, Key Co., E. St. Louis, Ill.; H. W. Meyer, General Steel Castings Corp., Granite City, Ill.; J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.; and J. B. Caine, Wyoming, Ohio.

5:30 PM—Registration Closes Exhibits Close

7:00 PM—A.F.S. Alumni Dinner

Cleveland Athletic Club (by invitation only)

M. E. Brooks

G. E. Tisdale

B. N. Ames

THURSDAY, MAY 11 (Cont'd)

8:00 PM (A)—Gray Iron Shop Course

(Sponsored by Gray Iron Division)

Presiding—H. H. Wilder, Foundry Div., Eaton Mfg. Co., Vassar, Mich.

Co-Chairman—E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.

Subject—"*Cupola Refractory Practice.*"

Discussion Panel—E. J. Lally, Forest City Foundries Co., Cleveland, and T. Giszczak A.F.S. Research Metallurgist, Detroit.

8:00 PM (B)—Plant and Plant Equipment Session

(Sponsored by Plant and Plant Equipment Committee)

Presiding—James Thomson, Continental Foundry & Machine Co., East Chicago, Ind.

Co-Chairman—H. W. Johnson, Wells Mfg. Co., Skokie, Ill.

"*Foundry Cleaning Room Abrasive Operations*"— B. H. Work, Carborundum Co., Niagara Falls, N. Y.

"*Salvage of Castings by Welding of Defects*"—G. E. Bellew, Air Reduction Sales Co., New York.

"*Use of Portable Air Tools in Foundry Cleaning Rooms*"—A. G. Ringer, Ingersoll-Rand Co., New York.

"*Material Transport in the Cleaning Room*"—N. L. Smith, Link-Belt Co., New York, and R. J. Wolf, Stone & Webster Engineering Corp., Boston.

8:00 PM (C)—Sand Shop Course

(Sponsored by Sand Shop Course Committee)

Presiding—R. H. Jacoby, Key Co., East St. Louis, Ill.

Co-Chairman—H. W. Meyer, General Steel Castings Co., Granite City, Ill.

Subject—"*Sand Reclamation.*"

Discussion Leader—G. H. Curtis, Nichols Engineering & Research Co., New York.

FRIDAY, MAY 12

9:00 AM—Registration Opens Exhibits Open

10:00 AM (A)—Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—F. J. Walls, International Nickel Co., Detroit.

Co-Chairman—G. A. Timmons, Climax Molybdenum Co., Detroit.

"*Correlation of Properties of Gray Iron*"—R. G. Mc-Elwee, Vanadium Corp. of America, Detroit, and R. Schneidewind, University of Michigan, Ann Arbor.

"*The Relaxation of Cast Iron*"—B. T. Malcolm and S. Low, Chapman Valve Co., Indian Orchard, Mass.

M. G. Dietl

J. G. Dick

V. Paschkis

10:00 AM (B)—Steel Session

(Sponsored by Steel Division)

Presiding—L. H. Hahn, Sivyer Steel Castings Co., Chicago.

Co-Chairman—J. K. McBroom, Stainless Foundry & Engineering Co., Milwaukee.

"*Manganese Recovery in Acid Electric Steel Making*"—S. F. Carter, American Cast Iron Pipe Co., Birmingham, Ala.

"*Metal Composition Tests for the Steel Melter*"— H. H. Fairfield, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont., Canada.

2:00 PM (A)—Joint Gray Iron and Malleable Session

(Jointly Sponsored by Gray Iron and Malleable Divisions)

Presiding—J. W. Bolton, Lunkenheimer Co., Cincinnati.

Co-Chairman—V. A. Crosby, Climax Molybdenum Co., Detroit.

"*Dilatometer Studies of Nodular Cast Iron*"—N. A. Ziegler, W. L. Meinhart, and J. R. Goldsmith, Crane Co., Chicago.

"*Nodular Iron vs. Section Size*"—G. Vennerholm, H. N. Bogart, and R. B. Melmoth, Ford Motor Co., Dearborn, Mich.

2:00 PM (B)—Steel Session

(Sponsored by Steel Division)

Presiding—C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.

Co-Chairman—C. H. Lorig, Battelle Memorial Institute, Columbus, Ohio.

"*The Fayalite Reaction in Sand Molds Used for Steel Castings*"—H. F. Taylor, Massachusetts Institute of Technology, Cambridge, and R. E. Savage, International Nickel Co., New York.

"*Relation of Thermal Gradients to the Soundness of Cast Steel Plates*"—H. F. Bishop, Naval Research Laboratory, Washington, D. C.

4:00 PM (A)—Joint Gray Iron and Steel Session

(Jointly Sponsored by Gray Iron and Steel Divisions)

Presiding—T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

Co-Chairman—H. H. Kessler, Sorbo-Mat Process Engineers, St. Louis.

"*Principles of Risering*"—Colored Slides—C. F. Walton, Case Institute of Technology, Cleveland.

"*Principles of Gating*"—W. H. Johnson, W. O. Baker, and W. S. Pellini, Naval Research Laboratory, Washington, D. C.

4:30 PM—Exhibits Close

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Foundry Congress

CONVENTION

(Continued from Page 59)

Refractories session at 10:00 a.m., Wednesday, will feature a paper on *"Refractory Practice in Melting Acid Steel,"* by R. H. Jacoby and Marshall Petty of the Key Co., East St. Louis, Ill.

Management Functions and Controls session, jointly sponsored by the A.F.S. Foundry Cost and Timestudy and Methods Committees 10:00 a.m., Thursday, May 11, will have C. T. Hassell of Lester B. Knight & Associates, Inc., Chicago, speaking on *"Administration of Wage Incentives,"* and W. E. George of Booz, Allen & Hamilton, Chicago, speaking on *"Organizing Management for Profit."*

In addition these committees will each have separate sessions on Thursday, May 11—Timestudy and Methods at 2:00 p.m., with R. H. Williams of Williams Management Engineering, Milwaukee, speaking on *"Standard Data for Bench Coremaking,"* and M. E. Annich of American Brake Shoe Co., Mahwah, N. J., speaking on *"Fatigue Data Survey"*—Foundry Cost session at 4:00 p.m. will feature *"Management Views Costs,"* presented by J. A. Wagner of the Wagner Malleable Iron Co., Decatur, Ill.

Two sessions will be held by the A.F.S. Plant & Plant Equipment Committee, the first at 4:00 p.m., Thursday, May 11, with three papers: *"Oxygen Cutting Processes in Steel Foundries,"* by R. Babcock of the Linde Air Products Co., Development Div., Newark, N. J.; *"Bandsawing in Foundries,"* by G. H. Sheppard, DoALL Co., Des Plaines, Ill.; and *"Selection and Application of Cleaning Equipment,"* by S. F. Krzeszewski of the American Wheelabrator & Equipment Co., Mishawaka, Ind.

The second Plant & Plant Equipment Committee session will be held at 8:00 p.m., with four papers: *"Foundry Cleaning Room Abrasive Operations,"* by B. H. Work, Carborundum Co., Niagara Falls, N. Y.; *"Salvage of Castings by Welding of Defects,"* by G. E. Bellew, Air Reduction Sales Co., New York; *"Use of Portable Air Tools in Foundry Cleaning Rooms,"* by A. G. Ringer, Ingersoll-Rand Co., New York; and *"Material Transport in the Cleaning Room,"* by N. L. Smith, Link-Belt Co., and R. J. Wolf, Stone & Webster Engineering Corp., Boston.

EXHIBITS

1950 A.F.S. Foundry Show, to be held in conjunction with the 54th A.F.S. Foundry Congress in Cleveland, May 8-12, promises to be one of the most complete and interesting displays of foundry equipment and supplies ever staged by the industry.

More than 225 of the nation's outstanding suppliers of foundry materials and equipment will display their products in exhibits occupying more than 75,000 square feet of floor space in the Auditorium Exhibit Hall, North Exhibit Hall, Arcade and Upper and Lower Lakeside Halls of Cleveland's gigantic Municipal Auditorium. Foundrymen from all over the world will be drawn to this Mecca of latest developments in equipment, supplies and services.

This year, for the first time in 14 years, overseas firms will exhibit their products, and for the first time in many years, molten metal will be poured by equipment firms as part of their displays.

One of the featured exhibits of the 1950 Foundry Show will be a joint complete foundry operating display, sponsored by four cooperating companies. This exhibit will occupy a space of 200 feet frontage in lower Lakeside Hall, and will show how sand can be reclaimed and used to advantage in the foundry.

Reclaimed sand will be mixed with bonding material and discharged into the hopper of a coreblower. Green molds will be conveyed to vertical core oven, baked, assembled on a conveyor and passed on to the pouring zone, where they will be poured in aluminum melted in a crucible furnace. Poured molds will then pass to the shakeout, where molds will be broken and the casting cut from the gate. Completed castings will then be given out as souvenirs.

On the facing page starts the list of exhibitors who will contribute to making the 1950 A.F.S. Congress outstanding in the industry's history.

AND EXHIBITORS

LIST OF EXHIBITORS
1950 A.F.S. FOUNDRY SHOW

Accurate Match Plate Co., Inc.	Chicago, Ill.
The Adams Co.	Dubuque, Iowa
Aerodyne Development Corp.	Cleveland, Ohio
Air Reduction Sales Co.	New York, N. Y.
Ajax Electrothermic Corp.	Trenton, N. J.
Ajax Engineering Co.	Trenton, N. J.
Ajax Flexible Coupling Co.	Westfield, N. Y.
Ajax Metal Co.	Trenton, N. J.
Allis-Chalmers Mfg. Co.	Milwaukee, Wis.
Alloy Metal Abrasive Co.	Ann Arbor, Mich.
The Alpha-Lux Co., Inc.	New York, N. Y.
American Air Filter Co., Inc.	Louisville, Ky.
American Colloid Co.	Chicago, Ill.
American Crucible Co.	North Haven, Conn.
American Gas Association	New York, N. Y.
American Metal Market	New York, N. Y.
American Silica Sand Co.	Ottawa, Ill.
American Steel Abrasive Co.	Galion, Ohio
American Wheelabrator & Equipment Corp.	Mishawaka, Ind.
Apex Smelting Co.	Chicago, Ill.
The Asbury Graphite Mills, Inc.	Asbury, N. J.
Avers Mineral Co.	Zanesville, Ohio
Bakelite Div., Union Carbide & Carbon Corp.	New York, N. Y.
Baroid Sales Div., National Lead Co.	Chicago, Ill.
C. O. Bartlett & Snow Co.	Cleveland, Ohio
Bay State Abrasive Products Co.	Westboro, Mass.
Beardsley & Piper Div., Pettibone Mulliken Corp.	Chicago, Ill.
Black Products Co.	Chicago, Ill.
Black, Sivalls & Bryson, Inc.	Kansas City, Mo.
Blaw-Knox Co.	Pittsburgh, Pa.
Blystone Div., Standard Sand & Machine Co.	Chicago, Ill.
The Borden Co.—Chemical Div.	New York, N. Y.
British Moulding Machine Co. Ltd.	Faversham, Kent, England
Buckeye Products Co.	Cincinnati, Ohio
Campbell-Hausfeld Co.	Harrison, Ohio
Canton Chaplet & Mfg. Co.	Canton, Ohio
The Carborundum Co.	Niagara Falls, N. Y.
Carl Mayer Corp.	Cleveland, Ohio
Central Silica Co.	Zanesville, Ohio
Centrifugal Casting Machine Co.	Tulsa, Okla.
Chain Belt Co.	Milwaukee, Wis.
Champion Foundry & Machine Co.	Chicago, Ill.
Clearfield Machine Co.	Clearfield, Pa.
Cleco Div., Reed Roller Bit Co.	Houston, Tex.
The Cleveland Crane & Engineering Co.	Wickliffe, Ohio
The Cleveland Flux Co.	Cleveland, Ohio
The Cleveland Metal Abrasive Co.	Cleveland, Ohio
Cleveland Quarries Co.	Cleveland, Ohio
Cleveland Vibrator Co.	Cleveland, Ohio
Climax Molybdenum Co.	New York, N. Y.
Clipper Mfg. Co.	Kansas City, Mo.
L. A. Cohn & Bro., Inc.	Chicago, Ill.
Coleman Engineering Co.	Chattanooga, Tenn.
Combined Supply & Equipment Co.	Buffalo, N. Y.

Corn Products Sales Co.	New York, N. Y.
Crescent Machine Div., Rockwell Mfg. Co.	Leetonia, Ohio
D C M T Sales Corp.	New York, N. Y.
Davenport Machine & Foundry Co.	Davenport, Ia.
Dayton Oil Co.	Dayton, Ohio
Dayton Pneumatic Tool Co.	Dayton, Ohio
Delhi Foundry Sand Co.	Cincinnati, Ohio
Delta Mfg. Div., Rockwell Mfg. Co.	Milwaukee, Wis.
Delta Oil Products Co.	Milwaukee, Wis.
Wm. Demmler & Bros.	Kewanee, Ill.
Detroit Electric Furnace Div. Kuhlman Electric Co.	Bay City, Mich.
Diamond Clamp & Flask Co.	Richmond, Ind.
Harry W. Dietert Co.	Detroit, Mich.
Joseph Dixon Crucible Co.	Jersey City, N. J.
DoALL Cleveland Co.	Cleveland, Ohio.
Dougherty Lumber Co.	Cleveland, Ohio
Durez Plastics & Chemicals, Inc.	North Tonawanda, N. Y.
Eastern Clay Products, Inc.	Jackson, Ohio
Eastman Kodak Co.	Rochester, N. Y.
Economy Tool & Machine Co.	Muskegon, Mich.
Electric Controller & Mfg. Co.	Cleveland, Ohio
Electro Metallurgical Div. Union Carbide & Carbon Corp.	New York, N. Y.
Electro Refractories & Alloys Corp.	Buffalo, N. Y.
Exomet, Inc.	Conneaut, Ohio
Exothermic Alloys Sales & Service, Inc.	Chicago, Ill.
The Fanner Mfg. Co.	Cleveland, Ohio
The Federal Foundry Supply Co.	Cleveland, Ohio
Federated Metals Div. American Smelting & Refining Co.	New York, N. Y.
Fisher Furnace Div. Lindberg Engineering Co.	Chicago, Ill.
Foundries Materials Co.	Coldwater, Mich.
The Foundry	Cleveland, Ohio
Foundry Educational Foundation	Cleveland, Ohio
Foundry Equipment Co.	Cleveland, Ohio
Foundry Service Co.	Birmingham, Ala.
Fox Grinders, Inc.	Pittsburgh, Pa.
Foxboro Co.	Foxboro, Mass.
The Freeman Supply Co.	Toledo, Ohio
The Fremont Flask Co.	Fremont, Ohio
General Electric X-Ray Corp.	Milwaukee, Wis.
Girdler Corp., Thermex Div.	Louisville, Ky.
Globe Steel Abrasive Co.	Mansville, Ohio
Claud S. Gordon Co.	Chicago, Ill.
Gray Iron Founders' Society, Inc.	Cleveland, Ohio
Great Lakes Carbon Corp.	Niagara Falls, N. Y.
Great Lakes Foundry Sand Co.	Detroit, Mich.
Great Western Mfg. Co.	Leavenworth, Kan.
Harbison-Walker Refractories Co.	Pittsburgh, Pa.
Harnischfeger Corp.	Milwaukee, Wis.
Benj. Harris & Co.	Chicago, Ill.
Norman Harrison & Co.	Chattanooga, Tenn.
Harrison Machine Co.	Erie, Pa.
Hercules Powder Co.	Wilmington, Del.
Herman Pneumatic Machine Co.	Pittsburgh, Pa.
Hewitt-Robins, Inc. Robins Conveyors Div.	New York, N. Y.
Hickman, Williams & Co.	Cleveland, Ohio
Hill & Griffith Co.	Cincinnati, Ohio
Hines Flask Co.	Cleveland, Ohio
The Hoffman Foundry Supply Co.	Cleveland, Ohio
Frank G. Hough Co.	Libertyville, Ill.
E. F. Houghton & Co.	Philadelphia, Pa.
Hougland & Hardy, Inc.—Hardy Sand Co.	Evansville, Ind.
Hydro Blast Corp.	Chicago, Ill.
Hyster Co.	Portland, Ore.

(Continued on following page)

1950 CONVENTION EXHIBITORS

(Continued from preceding page)

Illinois Clay Products Co. ..... Chicago, Ill.
Illinois Testing Labs., Inc. ..... Chicago, Ill.
Industrial Fabricating, Inc. ..... Eaton Rapids, Mich.
Industrial Minerals Co. ..... Lancaster, Ohio

International Graphite & Electrode Corp. ..... St. Marys, Pa.
International Molding Machine Co. ..... LaGrange Park, Ill.
International Nickel Co., Inc. ..... New York, N. Y.
Iron Age ..... New York, N. Y.
Iron Lung Ventilator Co. ..... Cleveland, Ohio

Jeffrey Mfg. Co. ..... Columbus, Ohio
William F. Jobbins, Inc. ..... Aurora, Ill.
Johnston & Jennings Div., Pettibone Mulliken Corp. ..... Chicago, Ill.

K & F Metal Spray Industries ..... Detroit
The Kindt-Collins Co. ..... Cleveland, Ohio
Andrew King ..... Narberth, Pa.
Lester B. Knight & Associates ..... Chicago, Ill.
Wm. Korn, Inc. ..... New York, N. Y.
H. Kramer & Co. ..... Chicago, Ill.
Kwik-Mix Co. ..... Port Washington, Wis.

Laboratory Equipment Corp. ..... St. Joseph, Mich.
Lava Crucible Co. of Pittsburgh ..... Pittsburgh, Pa.
R. Lavin & Sons, Inc. ..... Chicago, Ill.
Leco Products ..... Ferndale, Mich.
Link Belt Co. ..... Chicago, Ill.

Macklin Co. ..... Cincinnati, Ohio
The Macleod Co. ..... Cincinnati, Ohio
Magnaflux Corp. ..... Chicago, Ill.
Manley Sand Co. ..... Rockton, Ill.
Martin Engineering Co. ..... Kewanee, Ill.
Martindale Electric Co. ..... Cleveland, Ohio
Master Pneumatic Tool Co., Inc. ..... Cleveland, Ohio
Mathews Conveyers Co. ..... Ellwood City, Pa.
J. S. McCormick Co. ..... Pittsburgh, Pa.
Metallizing Co. of America ..... Chicago, Ill.
Mexico Refractories Co. ..... Mexico, Mo.
Michigan Smelting & Refining Div.
  Bohn Aluminum & Brass Corp. ..... Detroit, Mich.
Millwood Sand Co. ..... Zanesville, Ohio
Minco Products Corp. ..... Saginaw, Mich.
Mine Safety Appliances Co. ..... Pittsburgh, Pa.
Modern Equipment Co. ..... Port Washington, Wis.
The Monk Tool Co. ..... Geneva, Ill.
Monsanto Chemical Co. ..... St. Louis, Mo.
The Moulders' Friend ..... Dallas City, Ill.

Nassau Smelting & Refining Co. ..... Staten Island, N. Y.
National Carbon Div.
  Union Carbide & Carbon Corp. ..... New York, N. Y.
National Crucible Co. ..... Philadelphia, Pa.
National Engineering Co. ..... Chicago, Ill.
National Foundry Assn. ..... Chicago, Ill.
National Spectrographic Laboratories, Inc. ..... Cleveland, Ohio
Newaygo Engineering Co. ..... Newaygo, Mich.
New Jersey Silica Sand Co. ..... Millville, N. J.
Niagara Falls Smelting & Refining Div.
  Continental Copper & Steel Industries, Inc. ..... Buffalo, N. Y.
Wm. H. Nicholls Co., Inc. ..... Richmond Hill, N. Y.
Nichols Engineering & Research Corp. ..... New York, N. Y.
North American Smelting Co. ..... Wilmington, Del.
Norton Co. ..... Worcester, Mass.

S. Obermayer Co. ..... Chicago, Ill.
Oliver Machinery Co. ..... Grand Rapids, Mich.
The Osborn Mfg. Co. ..... Cleveland, Ohio

P M S Co. ..... Cleveland, Ohio
Pangborn Corp. ..... Hagerstown, Md.
Peerless Mineral Products Co. ..... Conneaut, Ohio
Peninsular Grinding Wheel Co. ..... Detroit, Mich.
Penola Inc. ..... Detroit, Mich.
George F. Pettinos, Inc. ..... Philadelphia, Pa.
Pittsburgh Crushed Steel Co. ..... Pittsburgh, Pa.
Pittsburgh Lectromelt Furnace Corp. ..... Pittsburgh, Pa.
Precision Grinding Wheel Co., Inc. ..... Philadelphia, Pa.
The Pyro Refractories Co. ..... Oak Hill, Ohio
Pyrometer Instrument Co., Inc. ..... Bergenfield, N. J.

The Ready-Power Co. ..... Detroit, Mich.
Redford Iron & Equipment Co. ..... Detroit, Mich.
W. G. Reichert Engineering Co. ..... Newark, N. J.
Reliable Castings Corp. ..... Cincinnati, Ohio
Republic Coal & Coke Co. ..... Chicago, Ill.
H. H. Robertson Co. ..... Pittsburgh, Pa.
Robinson Clay Products Co. ..... Akron, Ohio
Rockwell Mfg. Co.
  Power Tool Div. ..... Milwaukee, Wis.
Roots-Connersville Blower Corp. ..... Connersville, Ind.
J. O. Ross Engineering Corp. ..... New York, N. Y.
Ross-Taconv Crucible Co. ..... Philadelphia, Pa.
Rossborough Supply Co. ..... Cleveland, Ohio
The Rotor Tool Co. ..... Cleveland, Ohio
Rover Foundry & Machine Co. ..... Kingston, Pa.

Safety Clothing & Equipment Co. ..... Cleveland, Ohio
Safety First Shoe Co. ..... Holliston, Mass.
Sand Products Corp. ..... Cleveland, Ohio
Claude B. Schneible Co. ..... Detroit, Mich.
A. Schrader's Son Div.
  Scovill Mfg. Co., Inc. ..... Brooklyn, N. Y.
Schramm Inc. ..... West Chester, Pa.
I. Schumann & Co. ..... Cleveland, Ohio
Scientific Cast Products Corp. ..... Cleveland, Ohio
Semet-Solvay Div., Allied Chemical & Dye Corp. ..... New York, N. Y.
Severance Tool Industries, Inc. ..... Saginaw, Mich.
Simonds Abrasive Co. ..... Philadelphia, Pa.
Simplicity Engineering Co. ..... Durand, Mich.
Werner G. Smith Co. ..... Cleveland, Ohio
Smith Facing & Supply Co. ..... Cleveland, Ohio
Smith Oil & Refining Co. ..... Rockford, Ill.
Smith & Richardson Mfg. Co. ..... Geneva, Ill.
Solvay Sales Div., Allied Chemical & Dye Corp. ..... New York, N. Y.
Sorbo-Mat Process Engineers ..... St. Louis, Mo.
Spencer Turbine Co. ..... Hartford, Conn.
SPO Inc.—Milwaukee Foundry Equipment Div. ..... Cleveland, Ohio
Standard Conveyor Co. ..... No. St. Paul, Minn.
Standard Horse Nail Corp. ..... New Brighton, Pa.
Steel ..... Cleveland, Ohio
Steel Shot & Grit Co. ..... Boston, Mass.
Steel Shot Producers, Inc. ..... Butler, Pa.
Sterling Wheelbarrow Co. ..... Milwaukee, Wis.
Frederic B. Stevens, Inc. ..... Detroit, Mich.
Stoller Chemical Co. ..... Akron, Ohio
Stroman Furnace & Engineering Co. ..... Franklin Park, Ill.
Sutter Products Co. ..... Dearborn, Mich.
Swan-Finch Oil Corp. ..... New York, N. Y.

Tabor Mfg. Co. ..... Philadelphia, Pa.
Taggart Brimfield Co. ..... Hammonton, N. J.
Tamms Industries, Inc. ..... Chicago, Ill.
Thiem Products, Inc. ..... Milwaukee, Wis.
Tinchet Products Co. ..... Sycamore, Ill.
Titanium Alloy Mfg. Div., National Lead Co. ..... New York, N. Y.
Toledo Scale Co. ..... Toledo, Ohio
Towmotor Corp. ..... Cleveland, Ohio
Tri-State Sand Co. ..... Warrington, Pa.

Union Steel Products Co. ..... Albion, Mich.
United Oil Mfg. Co. ..... Erie, Pa.
U. S. Graphite Co., Div. of the Wickes Corp. ..... Saginaw, Mich.
U. S. Gypsum Co., Ind. Sales Div. ..... Chicago, Ill.
U. S. Hoffman Machinery Corp. ..... New York, N. Y.
U. S. Reduction Co. ..... East Chicago, Ind.

Vanadium Corp. of America ..... New York, N. Y.
Velsicol Corp. ..... Chicago, Ill.
Vesuvius Crucible Co. ..... Pittsburgh, Pa.

Wheelco Instruments Co. ..... Chicago, Ill.
White Pine Lumber Co. ..... Chicago, Ill.
Whitehead Brothers Co. ..... New York, N. Y.
Whiting Corp. ..... Harvey, Ill.

Zanesville Sand Co. ..... Zanesville, Ohio

Convention PLANT VISITATIONS

LARGEST CASTINGS PRODUCING AREA in the nation, Cleveland with its large variety of non-ferrous, gray iron, malleable and steel foundries, will open the doors of its castings industry to visitors to the 54th A.F.S. Foundry Congress and Show on May 8, 9 and 11. Open for inspection by visiting foundrymen will be two non-ferrous foundries, two steel, two heavy gray iron, five light gray iron, two malleable and one aluminum foundries, in addition to two pattern shops.

Visiting foundrymen are invited to witness a variety of foundry production methods—mechanized, semi-mechanized, squeezer, bench and rollover equipment, medium and heavy floor work—and the making of castings for the aircraft, machine tool, automotive, hardware, electrical, plumbing, marine engine, heating and ventilating industries.

Visitors to the 54th A.F.S. Foundry Congress and Show in Cleveland, May 8-12, desiring to visit the plants listed and described on this page are requested to register at the Plant Visitation Booth, to be located in Convention Headquarters. Prominent Cleveland foundrymen, members of the A.F.S. Northeastern Ohio Chapter, hosts to the 54th A.F.S. Foundry Congress & Show, will be on hand to offer guidance and further details on plant visitations.

John Harsch Bronze & Foundry Co., 12502 Berea Rd.
Non-ferrous foundry producing castings of varied sizes, using squeezer, bench and rollover equipment. Open from 2:00 to 4:00 p.m., Tuesday, May 9.

Republic Brass Co., 1623 East 45th St.
Non-ferrous foundry producing plumbing supplies. Mechanized. Open 2:00 to 4:00 p.m., Tuesday, May 9.

West Steel Castings Co., 805 East 70th St.
Semi-mechanized steel foundry casting truck and road machinery, machine tool parts. General jobbing. Open 8:30 a.m. to 11:00 a.m., Tuesday, May 9, and Thursday, May 11.

Crucible Steel Casting Co., Almira and West 84th Sts.
Mechanized steel foundry producing castings ranging in weight from ½ lb to 1,000 lb, and averaging 45 lb for locomotives, machine tools and power shovels. Open from 2:00 p.m. to 4:00 p.m. May 9 and 11.

Bowler Foundry Co., 4255 East 49th St.
Gray Iron Foundry using heavy and medium floor work production methods for general jobbing castings, press and steam shovel parts. Open from 2:00 p.m. to 4:00 p.m., Tuesday, May 9, and Thursday, May 11.

Fulton Foundry & Machine Co., East 75th & Morgan Aves.
Semi-production, mechanized heavy gray iron foundry making forming dies, machine tools and parts and permanent molds. Open 9:00 a.m. to 12:00 noon, May 9 and 11.

Allyne-Ryan Foundry Co., Aetna Rd. and East 91st St.
Semi-production, light gray iron foundry making general and automotive castings. Open 9:00 a.m. to 12:00 noon, Tuesday, May 9, and Thursday, May 11.

Cleveland Foundry Co., 2818 Harvard Ave.
Light gray iron foundry using squeezer and cope and drag production methods to make stove plates, burners, venturi and motor parts. Open 9:00 a.m. to 11:30 a.m., Tuesday, May 9, and Thursday, May 11.

Ohio Foundry Co., 9812 Quincy Ave.
Light gray iron foundry using squeezer and cope and drag production methods to make castings for automotive parts, machine tools, stokers and furnaces. Open from 9:30 a.m. to 11:30 a.m., Tuesday, May 9.

Forest City Foundries Co., Plant B., W. 94th & Maywood Aves.
Machine molding light gray iron foundry in general jobbing production; jobbing castings weighing from 1 lb to 50 lb. Open from 9:00 a.m. to 12:00 noon, May 9 and 11.

Superior Foundry, Inc., 3542 East 71st St.
Semi production gray iron foundry making castings for heating equipment, machine tools, and automotive parts. Open from 1:00 p.m. to 3:30 p.m., May 9 and 11.

Eberhard Mfg. Co., 2731 Tennyson Ave.
Mechanized division of Eastern Malleable Iron Co. making automotive hardware, electrical fittings and locks. Open from 9:00 a.m. to 12 noon, Tuesday, May 9, and from 2:00 p.m. to 4:00 p.m. on Thursday, May 11.

National Malleable & Steel Castings Co., 10600 Quincy Ave.
Mechanized malleable iron foundry making automotive and marine castings. Open 9:00 a.m. to 12:00 noon, Tuesday, May 9, and 2:00 p.m. to 4:00 p.m., Thursday, May 11.

Aluminum Company of America, 2210 Harvard Ave.
Highly mechanized foundry producing a wide variety of aluminum castings for varied industries. Open from 2:00 p.m. to 4:00 p.m., Monday May 8. Visitors must register for plant trip not later than 1:00 p.m., Monday.

PATTERN SHOPS

Master Pattern Co., 1315 Main Ave.
Open from 2:00 p.m. to 4:00 p.m., May 9 and 11.

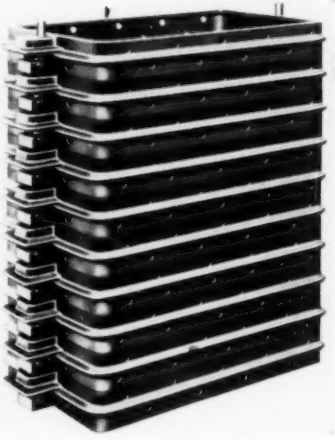
Motor Patterns Co., 3035 East 61st St.
Open from 9:00 a.m. to 12:00 noon, May 9 and 11.

EXHIBITS Preview

American Foundryman **herewith presents a preview of some of the foundry equipment, materials, and services to be exhibited at the 54th Annual Foundry Congress of the American Foundrymen's Society. Detailed information and a view of these and other products of the exhibitors can be obtained during the A.F.S. Show in the Cleveland Municipal Auditorium, May 8-12. Those unable to attend can request information on the coupon on Page 88. This is the third of three sections of Exhibits Preview. The first two sections of Exhibits Preview appeared in February and March.**

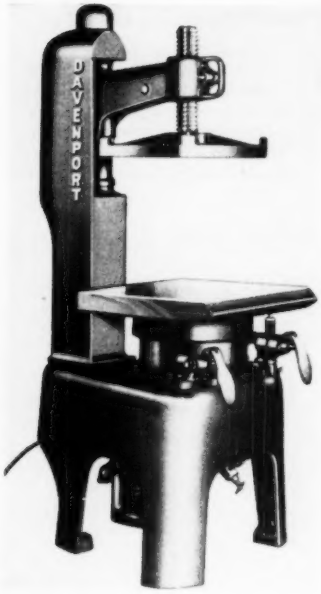
24. Flask Sections ➡

Sterling Wheelbarrow Co.'s exhibit at the 1950 A.F.S. Foundry Show will feature these flask sections, rigidly constructed to withstand squeeze in molding. Designed for multiple molding, these flask sections maintain pin centers at all times and have ample vent holes without weakening flask web. These rolled steel channel flasks insure correct pin and bushing clearances when worked with pattern plates.



⬅ **25. Sand Conditioner**

This self-propelled, self-loading sand conditioner unit, to be displayed in Royer Foundry & Machine Co.'s booth at the 1950 A.F.S. Foundry Show in Cleveland, performs all sand preparation operations by moving directly to sand heap, scooping up sand, moving it to combing belt and discharging it at a rate of up to 50 tons per hour. Compact (7 ft. 3 in. high x 5 ft. 4 in. wide x 7 ft. 3 in. long; weight, 5,000 lb), the unit's three motors use a total of 11 hp. One man controls all operations — moving forward or backward, loading, trash removal and complete sand conditioning — with minimum of labor.



26. Molding Machine

Davenport Machine & Foundry Co. will exhibit one of the newest of 60 models of modern foundry molding machines at the 54th A.F.S. Foundry Congress and Show. Model shown features electrically-controlled push-button squeeze.

27. Refractory Mortar

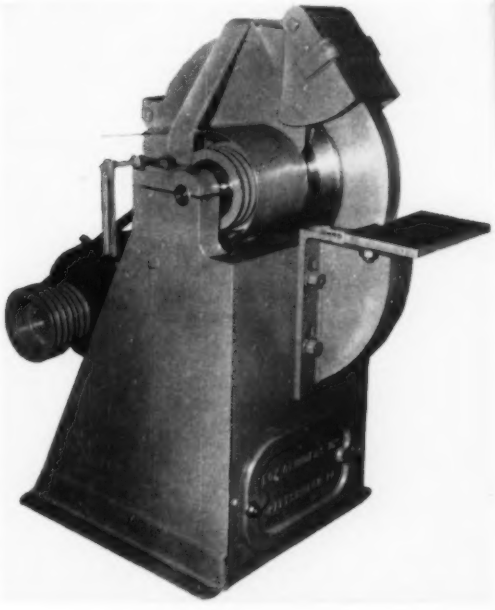
Mexico Refractories Co.'s booth at the Foundry Show will display Mex-Lox, a mortar for metal resistant linings. Properties are: slag and metal resistant; erosion resistant; non-shrinking; spall resistant, more refractory than most firebrick; easily dipped or troweled; and resistant to deterioration.

28. Optical Pyrometer

Designed for taking temperature readings of molten ferrous metals, is this new open-hearth optical pyrometer to be shown at Pyrometer Instrument Co.'s Foundry Show booth. Reading scale is 40 per cent longer and covers only critical portion of range required. Self contained, direct reading and lightweight, instrument allows reading of moving objects without correction.

29. High-Speed Grinder

Fox Grinders, Inc.'s exhibit will feature new series of high-speed stand grinders with special wheel mounting for maximum wheel clearance in grinding various casting shapes.

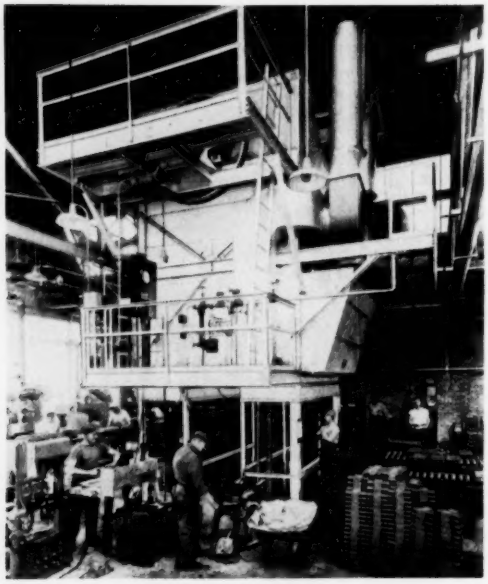


30. Vibrators

Highlight of Cleveland Vibrator Co.'s exhibit at the 1950 Foundry Show will be this new series SA of pneumatically-operated vibrators, recommended for such applications as removing matchplate patterns from sand molds, assuring steady flow from hoppers, vibrating packing tables, fatigue testing assemblies and moving granular materials through chutes, etc. Available in seven sizes, with mounting arrangements as shown.

31. Exothermic Products

Exothermic products, developed for the foundry industry, will be shown in Exomet, Inc.'s exhibit. Included in display will be Risotherm, for elimination of carrot-type shrinkage in risers; Ladletherm, for heating and adding alloys to ladles; Exocast for producing metal for castings without melting equipment; Exoweld for joining heavy sections of any desired analysis; and Thermogard Sleeves, for insulating non-ferrous castings.

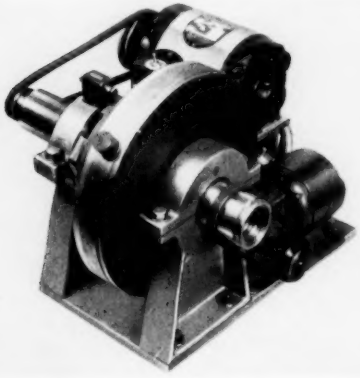


33. Tower Core Oven

Foundry Equipment Co.'s exhibit will feature two Coleman Tower Ovens. Generally used for small to medium cores, these ovens can be equipped with automatic loading and unloading for heavy cores, and are built in wide range of capacities. Model shown has patented center passageway providing better work space for coremakers, recirculating air heating and cooling systems and accurate temperature control for baking cores of any mix.

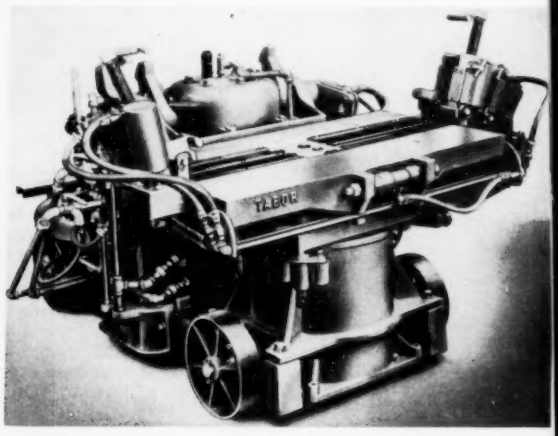
35. Foundry Sands

Joint exhibit of the Ayers Mineral Co., Central Silica Co., and Millwood Sand Co. will feature washed and dried silica sand, silica flour, high quality steel foundry and ceramic sands, and mulled, screened and aerated natural bonded molding sand.



32. Jar, Power Rollover Draw Machine

Jar, power rollover draw machine to be exhibited by Tabor Mfg. Co. features exclusive design which locks rollover plate to jar head during jarring. Feature prevents wear on plate and head, assures solid seating of plate at all times, and eliminates plate wobble even in handling of unevenly-weighted mold. Mold completes entire cycle in 35 seconds or less. Air-operated clamps and table design permit quick changeover.



34. Edge Grinder

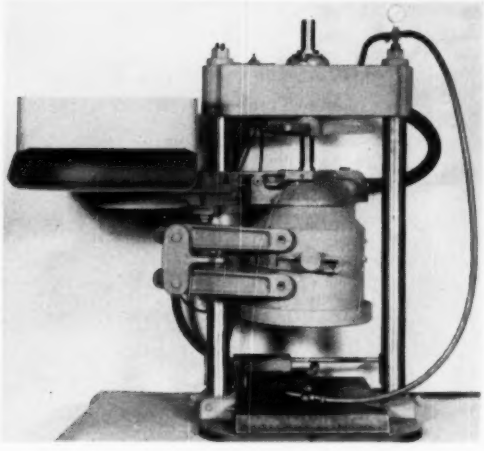
Cleco Division of Reed Roller-Bit Co. will display this edge grinder which performs roughing and final finishing operations without damage to surrounding surfaces. Adaptable to all metals. Weight: 8¾ lb. Height: 7¾ in. Free speed: 8,000 rpm. 7 x ¼ in. flexible wheel.

36. Shot and Grit Testing Machine

Alloy Metal Abrasive Co. will display this new proving machine at the 1950 Foundry Show. Machine will give accurate test of any blasting shot or grit by reproducing actual blasting conditions. Accurate measurement eliminates costly "buy and try" methods. Free demonstration in foundries with foundry's own shot or grit available.

37. Pattern Lumber ➡

Photograph shows one of the many processes through which Dougherty Lumber Co. products pass before they reach the foundry or the pattern shop. This Moore dry kiln is capable of handling 100,000 board ft of lumber at a time. Dougherty Lumber Co. will display samples of its complete line of lumber and foundry pattern equipment at the 1950 A.F.S. Foundry Congress and Show in Cleveland.

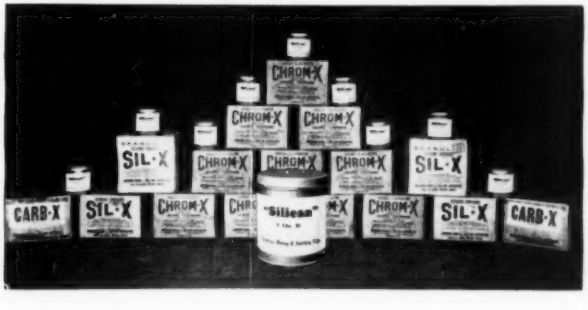


⬆ **38. Sand Blowing Machine**

Completely different in principle from any sand machine now manufactured is this unit which will be featured in Federal Foundry Supply Co.'s exhibit. Features are: capacity of 80 ½ lb cores without refilling of blow head, single cores up to 40 lb each; will blow oil sand, dry core compound sand or green facing sand; blows closed or open core boxes through one hole in blow plate; quick adjustability of blow head and sand hopper; flexible clamping plate; blow head is quickly and easily filled; will operate on 80 lb of air pressure or more.

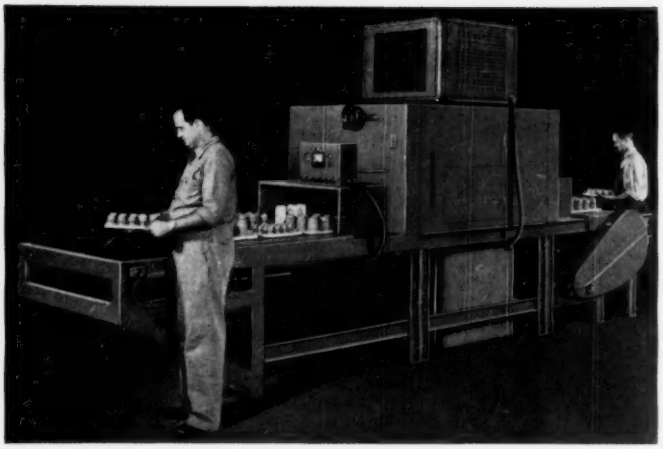
⬆ **39. Cutting Machines and Tools**

DoALL Co.'s Foundry Show exhibit will feature several new developments in machines and band cutting tools for castings, including the Contour-matic manufacturing machine which cuts every known solid material with operation from single control panel and (illustrated) the Super-Zephyr line of high-speed, low-cost band sawing machines, available in 21 models and featuring new cutting designs.



⬅ **40. Exothermic Alloys**

Exothermic Alloys Sales & Service, Inc.'s Foundry Show exhibit will feature Silican, a ferrosilicon briquette enclosed in a black iron can for addition to cupola charges. Silicon is claimed to ensure better control in that briquette reaches melting zone of cupola, providing required amount of silicon at point where it is needed. Other products to be exhibited are Chrom-X, Sil-X, and Riser-X, exothermic alloys. The first two are ladle additions and the third a riser addition.



41. High-Frequency Core Baker

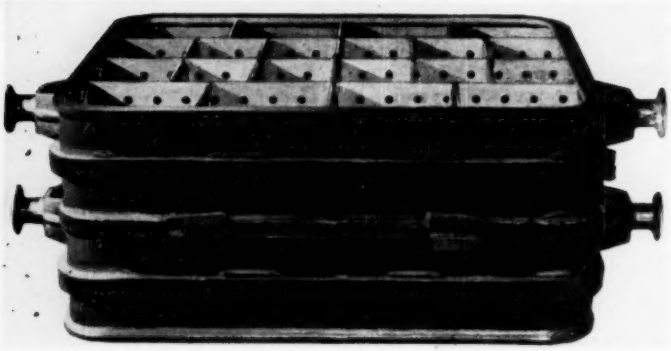
Highlight of the 1950 A.F.S. Foundry Show exhibit of the Thermex Division, Girdler Corp. will be this high-frequency core baking unit. Advantages claimed for this unit are complete, uniform and rigid baking of cores, plus a core room yield increase of nearly 100 per cent. There are no burned or broken surfaces to cause ridges, pits or fins in castings. Changes in molding schedules may be made on moment's notice. Heat is used effectively and economically, and fewer mixes are needed since one formulation can be used for a large variety of cores.

42. Molding Machine

Exhibited for the first time at the 1950 Foundry Show will be the No. 3160 Ro'a-Lift Molding Machine, highlight of Osborn Mfg. Co.'s exhibit. Rota-Lift is designed to run large matchplate patterns, using either tight, slip or pop-off flasks. Machine mechanically handles mold during rollover, draws cope, and closes mold, requiring only one operator and eliminating weight as a matchplate operating factor.

43. Binders and Wood Flour

American Colloid Co.'s exhibit will display three products developed for use in foundry sand mixtures: (1) Western Bentonite—a Wyoming Bentonite used for bonding molding sands and providing high hot and dry strengths, moderately high green strength and good durability; (2) Southern Bentonite—a Mississippi Bentonite imparting high green strength and moderate dry strengths to sands; and (3) wood flour—produced in Mississippi and used principally to reduce volume changes and to provide reducing atmosphere and to act as an extender for seacoals, cereals and pitches.

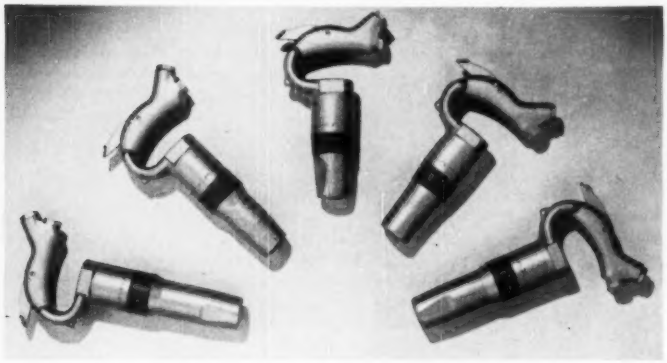


44. Heavy Duty Flask

Black, Sivalls & Bryson, Inc.'s exhibit at the 1950 Foundry Congress and Show, Cleveland, will feature the Style FP22R Heavy Duty Foundry Flask, designed for use where rigid construction is necessary. Flask will maintain original dimensions and pincenters over long period of time. Bearing bars are securely welded to walls, inside and out, assuring a flask that will stand up under any type of shakeout. Available in round, square, rectangular or special shapes, and can be used with any combination of pin lugs and special equipment.

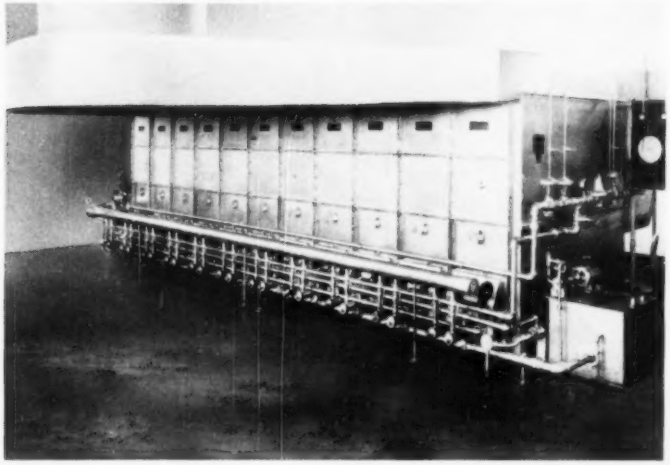
45. Chipping Hammers

Rotor Tool Co. will display its new line of five basic Multi-Power Chipping Hammers in its booth at the 1950 Foundry Show. These five basic hammers produce 15 combinations of speed, stroke and blow. Simple change of pistons gives operator "custom-fitted" tool for new steel and iron alloys. Eliminates valve and barrel breakage and cuts down hammer weight from 1 to 1½ lb.



46. Abrasive Helmet

Improved Blastfoe Abrasive Helmet will be featured in Mine Safety Appliances Co.'s exhibit. Lightweight, loose-fitting helmet employs compressed air under precise control. Hood resists high-velocity abrasives.



47. Cupola Hot Blast System

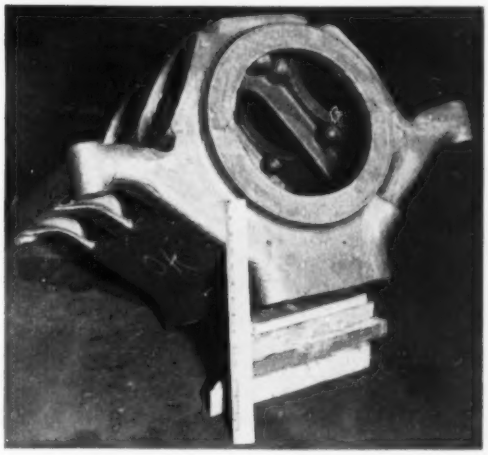
J. O. Ross Engineering Corp.'s hot-blast system, to be shown at the 1950 Foundry Show, takes cold air from blower, passes it through oil or gas-fired heaters and delivers it to cupola at 150F. Method effects coke savings, eliminates bridging, reduces labor and maintenance. Unit maintains uniform blast temperature and can be quickly installed without interrupting melting schedule.

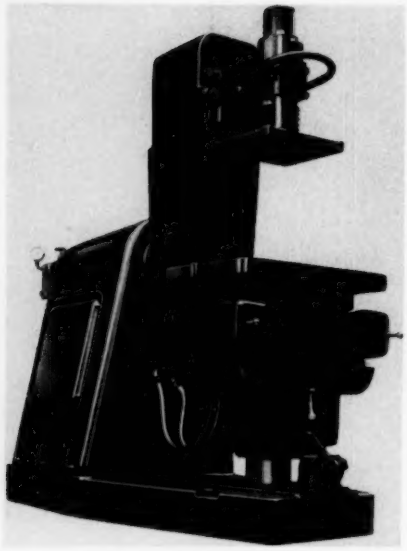
48. Mudding Compound

Featured product at the Frederic B. Stevens, Inc., exhibit will be the Stevens Slick-Seal Mudding Compound, which improves casting finish with no burn-ins, flash or fins. Compound remains plastic and workable through 8-hour shift, air dries in 1 to 2 hours for light applications, 4 to 5 hours for heavy applications. Edges will not shrink or curl. No crumbling, rolling or balling-up behind fingers.

49. Phenolic Resin Binder

This casting was bonded with a new phenolic resin binder, Thor Plastic Binder FB-108, to be shown at Borden Co.'s Foundry Show exhibit. Use of this binder brought about reduction in baking time from 9 to 4 hours, producing smooth surface shown.





50. Sand Additives, Mold and Core Washes

Delta Oil Products Co.'s exhibit at the 1950 A.F.S. Foundry Congress & Show will feature actual exhibits of complex cores and castings made with Delta laboratory-developed and controlled core and mold washes, Permi-Bond, Partex (nutshell parting), sand conditioning oil, Dri-Bond, Bondite, etc.

51. Molding Machine

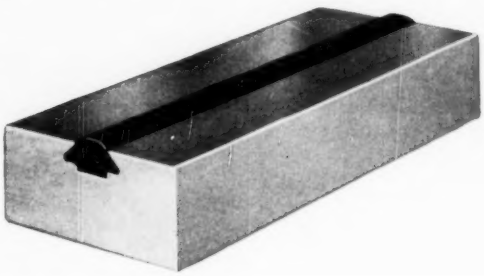
An exhibitor from overseas, British Molding Machine Co., Ltd., will display this Type B.T. molding machine featuring pushbutton operation, automatic jolt timer, fully-enclosed oil-operated turnover mechanism, automatic pneumatic anvil and automatic lubrication. Powerful squeeze action eliminates hand ramming and box clamping. Molding times compare favorably with straight-draw or pin-lift methods, plus added advantage of machine's ability to produce deep and intricate molds with green sand cores.

52. Core Box Seal

Martin Engineering Co.'s 1950 Foundry Show exhibit will display a new specially-shaped rubber strip that makes a positive core box seal at the parting line. Installed in groove cut in box face by the Martin Fly-Cutter, "Stripinsert" requires no adhesives and will not grow or crawl and may be changed in core room in a few minutes. Unit eliminates need for steel facing boxes.

53. Core Oil

Ten important characteristics of Penolyn Core Oil, to be featured at Penola, Inc.'s Foundry Show exhibit, and contributing to production of high-quality cores are: (1) Uniformity—no settling out in drums and tanks; (2) Concentrated Form—high sand to oil ratio; (3) No Obnoxious Odor; (4) No Seepage—will not settle or drain to bottom of sand mix; (5) No Crusting or Green Mix—air dries slowly; (6) Clean Working; (7) Wide Temperature Baking Range—no burn-outs, small and large cores bake simultaneously; (8) Polymerized Formulation—insures maximum strength; (9) Minimum Gas; (10) Ample Collapsibility—fewer cracked castings.



Exhibits Preview, AMERICAN FOUNDRYMAN, *616 S. Michigan Ave., Chicago 5, Ill.*

Please send manufacturers' literature on the Exhibits Preview items, indicated by circled numbers below, without cost or obligation to me.

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53		

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John S. Parker, SPO, Inc.
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H. R. Doswold, Permold Co., Medina, Ohio
J. E. Dvorak, Eberhard Manufacturing Co.
G. K. Eggleston, Non-Ferrous Perma Mold, Inc., Mansfield
Jack Kroecker, Aluminum Co. of America
Henry Macler, Sterling Foundry Co., Wellington, Ohio
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L. E. Rayel, Werner G. Smith Co.
Peter Rettig, Rettig Pattern Co.
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Ernest F. Thomas, Ohio Foundry Co.
Milton Tilley, National Malleable & Steel Castings Co.

Cleve H. Pomeroy

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Wm. C. Corbeau, National Malleable & Steel Castings Co.
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HOSTS . . . Continued

Vincent J. Sedlon

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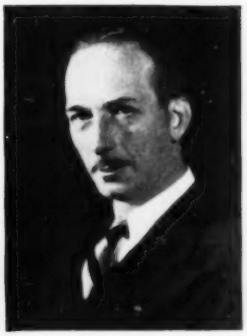

SELECTION AND APPLICATION OF CLEANING ROOM EQUIPMENT

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American Wheelabrator & Equipment Corp.
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MANY FACTORS ARE INVOLVED in the selection of proper cleaning room equipment. The principal considerations are: (1) cleaning ability; (2) initial cost of the equipment; (3) operating and maintenance cost; (4) safety and hygiene; (5) type of finish produced; and (6) miscellaneous factors such as the floor space required, noise, working conditions, etc.

The relative importance of these factors will vary from plant to plant and from time to time. Cost is always an important point and usually is the first consideration in the selection of equipment. Because of the over-all importance of the cost factor it will receive special attention throughout this paper.

In cases where production requirements are small, it may be desirable to sacrifice slightly on operating costs in order to reduce the initial investment. In other cases, the need for a special finish may require the purchase of equipment which is initially more expensive as well as more expensive to operate. In still other cases, safety and hygiene requirements may necessitate small sacrifices both in cost and finish.

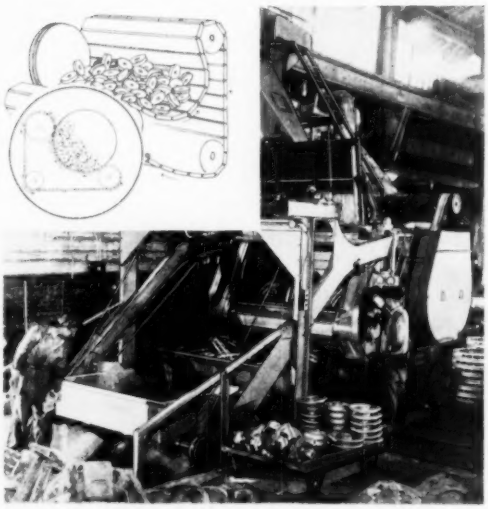
Advantages and Limitations Listed

These are decisions which an outsider cannot presume to make for the individual plant manager. Each knows his own conditions best and must carefully weigh the various factors according to the importance his own judgment places on them. The purpose of the present paper is to list and illustrate the various advantages and limitations of the different types of equipment available with the thought of providing foundrymen with basic facts. Since most advantages and disadvantages are relative values, clarity demands that we select some one method as the standard or norm to which all others will be compared. In this paper airless blast cleaning has been selected as the standard.

Airless Blast Cleaning: By utilizing centrifugal force to hurl the shot or grit, airless blast equipment provides an efficient method for throwing tremendous quantities of abrasive. Consequently, it offers high production rates with low labor requirements. In order to handle the volume of work that the process is capable of cleaning, and properly present all surfaces to the abrasive blast, special work-handling systems are frequently necessary. These generally result in an initial investment somewhat higher than that required for many other cleaning methods.

The process gives a thoroughly cleaned surface which is ideally suited for any subsequent coating or finishing operation. The fine matte finish produced presents an excellent bonding surface for plating or painting operations, and further cleaning or pickling is not generally required. The degree of cleanliness provided depends entirely on the requirements of the individual operator, and may vary from simply knocking off loose sand to the thorough removal of all burned-in sand and scale to leave a chemically clean surface.

With the work being handled mechanically while in the blast chamber, it is not necessary for an operator to work in the blast zone and the equipment can be



Heavy steel castings are cleaned in a typical heavy duty airless blast tumbling machine equipped with a skip for fast loading. The sketch shows the principle of operation of the continuous belt conveyor. As the apron conveyor moves in one direction, the work is tumbled and cascaded directly under the abrasive blast.

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totally enclosed in dust-tight housings. This, coupled with adequate ventilation, solves the dust problem and provides good working conditions.

Because of the highly abrasive nature of most of the non-metallic grits such as sand, aluminum oxide or silicon carbide, they cause excessive wear on airless blast equipment and their use is generally discouraged. An exception to this is in the use of the so-called "soft grits." These include such materials as crushed apricot pits or crushed walnut shells, which have but limited application in the foundry field.

Tumbling Equipment: One of the oldest and most widely used cleaning methods, the "tumbler" or "rattler," still is used by many foundries, especially the smaller ones. Tumblers have the advantage of a lower initial investment and of producing a type of finish which is very desirable in some applications. The rounded corners, partial removal of flash and smooth surface provided by the tumbler gives a pleasing appearance on some types of parts, and the method is occasionally written into specifications.

On the other hand, tumbling has several disadvantages. It has a relatively high operating cost from the standpoint of both labor and power required. It does a poor job of actually cleaning the surface of the casting, which is particularly undesirable if the casting is to be machined or plated. It leaves a film of dust and burned-in sand on the surface that resists plating and damages tools.

Make Cost Comparisons

Tumbling equipment requires considerable space for a given amount of production and is extremely noisy when steel liners are used in the barrel. Since the higher operating and maintenance costs of tumbling equipment nullify its lower initial cost, the only advantage to be claimed is the "tumbled finish" where this is desirable.

Here is a cost comparison between tumbling and airless blasting in a gray iron foundry producing agricultural castings. Five tumbling mills were replaced by one airless blast tumbling machine. Production increased from 10 tons cleaned in 9 hr to 20 tons cleaned in 10 hr. In spite of the doubled production, labor requirements decreased from 27 to 20 man-hours. Cleaning cost was reduced from $4.19 to $2.09 per ton.

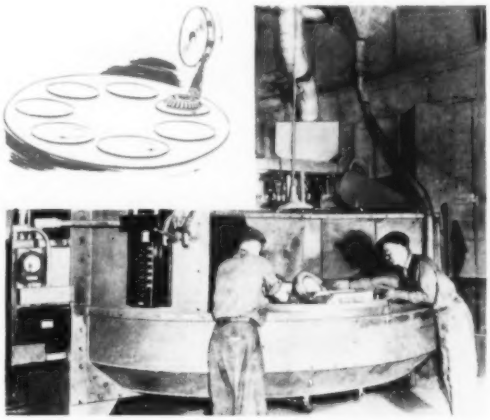
Another example involves the cleaning of building hardware in a small foundry. Three tumbling mills were replaced by one airless table-type machine. Although production increased from 2 tons to 4 tons per day, labor requirements were reduced from 12 to 6 man-hours, and cleaning costs from $8.09 to $2.65 per ton.

Sandblast: Cost-wise, sandblasting will frequently offer an advantage in the form of lower initial investment when an adequate supply of compressed air is already available. In the case of sandblast rooms requiring a large pit, or in those cases where additional air compressor capacity is required, this advantage may be lost.

The two inherent advantages of sandblast equipment are its ability to clean interior surfaces and the fact that non-metallic abrasive can be used economically. The narrow stream of abrasive projected through the conventional nozzle is ideally adapted for cleaning the interior surfaces of pipe or deep, narrow recesses in castings. In fact, an airblast touch-up chamber is sometimes incorporated in airless blast machines for this purpose.

Cast iron and steel abrasives may occasionally give unsatisfactory results on some types of materials such as stainless steel, aluminum, magnesium, and a few others. In these cases it is frequently recommended that a non-metallic abrasive be used. Since most of the non-metallic abrasives such as sand, silicon carbide or aluminum oxide cause excessive wear on airless blast equipment, they are generally used in conventional airblast types of equipment.

The process has several disadvantages, the principal one being the high operating cost of the equipment.



The sketch illustrates the operating principle of the multitable-type machine. The individual work tables rotate as they pass through the abrasive blast, exposing all casting surfaces to the cleaning action of the blast. In the operation shown, one man is loading and the other unloading the tables as they pass the opening.

A considerable amount of manual labor is generally required in the operation of sandblast equipment and the production rate is low, resulting in a high labor cost per ton of castings cleaned. Another important expense factor is the cost of compressed air. Where sizable production is involved, these high operating costs more than offset any saving in initial investment. Considerable difficulty is encountered in keeping the air dry and special traps and bleeds must be provided.

Unpleasant working conditions are generally found in sandblast operations because of the clouds of dust created, especially in sandblast rooms where the operator must work in the dusty atmosphere. Various precautionary measures such as the use of helmets, protective clothing and adequate ventilation tend to alleviate this condition.

Where uniformity of appearance is important over a large area, considerable difficulty may be experienced if airblast equipment is used. The narrow concentrated blast from the nozzle produces a mottled or a striped appearance unless unusual care is exercised.

In a large steel foundry pouring 1300 tons per month, three airblast rooms were replaced by a large airless blast tumbling machine. Labor requirements were cut from 50 to 19 man-hours daily, and cleaning costs from $3.56 to $2.41 per ton. In another steel jobbing foundry an airblast room and table were replaced by a special airless table-type room. Labor requirements were reduced from 59 to 24 man-hours daily, and cleaning costs from $4.75 to $3.38 per ton.

Wet Blasting: This method may be broken down into two general classifications—(1) core knock-out and/or heavy cleaning where high-pressure water, with or without the addition of sand, is the cleaning agent; and (2) fine finishing operations where water and finely divided abrasive materials are propelled by compressed air.

Both classifications have the great advantage of practically eliminating dust if the castings are cold. It has the same disadvantages as sandblasting except for the dust hazard. Because of the cost of high-pressure water, slow cleaning rate and manual labor required, the operating costs are generally high and may be prohibitive if any appreciable production volume is to be maintained. For fine finishing operations, liquid blasting has the advantage of permitting the use of extremely fine abrasives (even down to an estimated 2500 mesh) which could not be successfully handled in the dry state. For certain types of finishes this is a fundamental advantage.

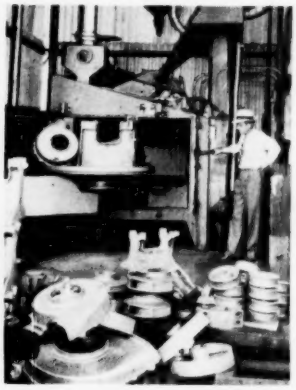
In his book, *Modern Blast Cleaning and Ventilation*, C. A. Reams gives several examples of the cost of hydraulic blasting compared to hand labor in core knockout. A few of these are:

Part	Hydro	Hand
Main engine frame	$0.80	$ 6.00
Bed Plate	1.10	11.00
Turbine end	7.20	30.00
Large runner	6.00	110.00

Unfortunately, no actual case histories are available to illustrate the relative economy of wet blasting and airless blasting.

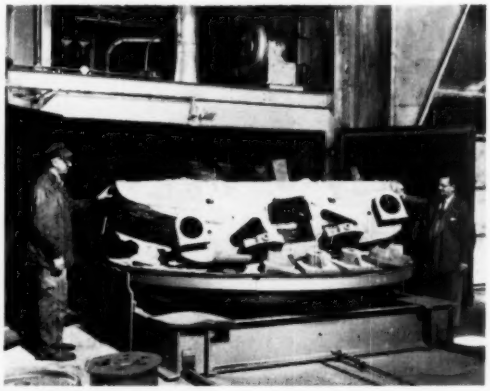
Pickling: While pickling is not as common a foundry operation as some of the other cleaning methods, it is encountered to some extent, especially where further finishing operations are required. Pickling offers the advantage of relatively low-cost operation plus the production of a thoroughly cleaned surface which is well suited for subsequent plating or coating.

The disadvantages of pickling are well known in the

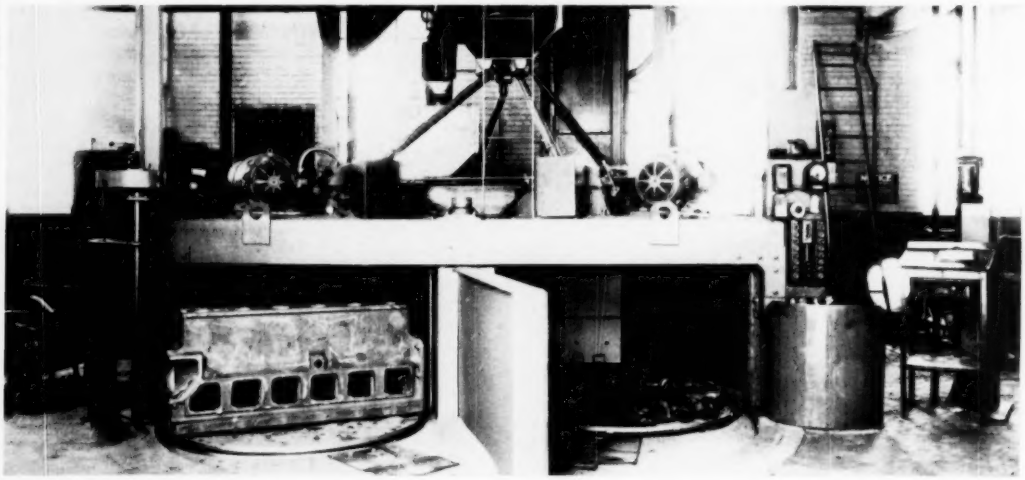


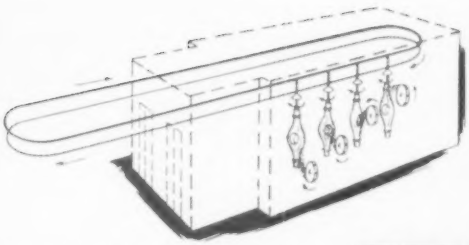
◀ *A swinging table type airless blast machine.*

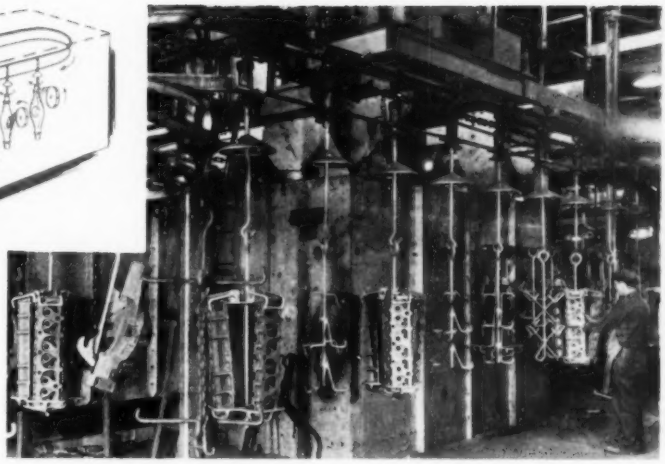
A special cabinet has ▶ *a rotating table mounted on a traveling car. This type of cabinet is particularly applicable for cleaning very heavy castings.*



▼ *Diesel engine castings are cleaned on this twin table type machine. While one table, loaded with work to be cleaned, rotates in the blast zone, the other is in the open for loading or unloading.*







The sketch illustrates the principle of operation of the special cabinet employing a monorail conveyor. The number of wheel units used depends on the type of work being cleaned and the production required. The individual hangers rotate the work in the blast zone. Left —View of a special monorail cabinet.

metal working industry. The most common objections are: (1) defects due to hydrogen embrittlement and smut formation; (2) the loss of virgin metal; (3) its relative ineffectiveness on some acid-resisting materials; (4) the hazard and unpleasantness of working with strong inorganic acids; and (5) the problem of disposal of the waste pickle liquor. In view of recent legislative efforts to reduce stream pollution, the problem of acid disposal is becoming increasingly serious.

Cleaning Costs Reduced

Recent developments in abrasive material have now reduced the cost of airless blasting to a point where it is competitive with pickling. In some cases it is actually less expensive.

Another case study, involving a forge shop instead of a foundry, offers a composite picture on several types of equipment. One medium size airless blast tumbling machine replaced five pickling tanks, two tumbling barrels, and one airblast table in cleaning 1000 tons per month. Labor requirements were reduced from 64 to 16 man-hours daily, and cleaning costs came down from $3.19 to $1.64 per ton.

Equipment Design: The design of equipment for handling the work in the cleaning room varies widely, depending upon the type and size of the parts to be cleaned and the cleaning method used. As pointed out earlier, work-handling methods become especially important in airless blasting. In many cases essentially the same handling methods may be used for other forms of cleaning, although tumbling, sandblast and pickling equipment generally rely on relatively simple systems involving manual operation.

The barrel for tumbling work is a basic type of handling method that is utilized by practically all of the cleaning methods. It is ideally suited for rugged, compact pieces which can withstand tumbling action.

In simple tumbling mills the barrel is partially filled with the work to be cleaned and rotated until most of the sand and scale have been removed by the action of the work pieces on each other. Jack stars may be added to the charge to assist in digging the sand and scale out of small pockets and recesses. In variations of this process certain liquids may be added to assist in the cleaning action or to serve as a carrier for abrasive compounds. In addition, the liquid may serve to reduce the creation of dust during the operation.

In airblast equipment it is obviously necessary that some sort of opening be provided through which the abrasive stream can be projected. This requirement was met by a type of equipment known as a tilted barrel—a machine basically similar to the earlier tumbling mill except that an opening was provided in one end, and that end was tilted up from the horizontal.

With the development of airless blasting it was necessary to have the barrel open over a considerable area to accommodate the wide, fan-shaped blast from the wheel unit. This condition was met by the use of a continuous belt conveyor shaped somewhat in the form of the letter *J*. This provided a constant, uniform tumbling action as in the earlier barrels but left the top of the mill open for mounting the wheel unit.

Handles Fragile Castings

Since the cleaning was performed by the blast stream, a violent tumbling action was not necessary and the continuous belt conveyor made it possible to handle the more fragile pieces. It offered another advantage in the ease with which the work could be inspected and unloaded. Being open on one side, as well as on top, it was necessary only to shut off the abrasive blast and open the door to ascertain the state of cleaning. For unloading, the conveyor could be reversed and the work automatically carried out into waiting tote boxes.

Table-Type Machines: For work which must be handled in considerable quantities but is too fragile or too flat to tumble satisfactorily, table-type machines were developed. Beginning with a simple plain table which revolves about its axis and carries the work through the abrasive blast, numerous variations have been devised. These include the multi-table where individual revolving work tables are passed through the abrasive blast, tables mounted on swinging doors, turntables, tables mounted on traveling cars, and other minor variations. Although most of these have been developed for use with airless-blast equipment, they

can be used in conjunction with airblast if desired.

Each of these table-types have certain advantages and limitations. For simple flat work the plain table generally offers adequate cleaning and production with the minimum initial investment. Where high vertical sides and deep recesses must be cleaned on work that is not suitable for tumbling, and if a relatively high production rate must be maintained, the multi-table is generally used. As the work rotates about its own axis while passing through the blast it offers an opportunity for the abrasive particles to strike it from virtually every angle.

If production rates are not too high and the work is of a large, bulky, or widely varying nature, the swinging table-type machine offers many advantages. With the table mounted on the door, the act of opening the door swings the table out into the open where it can be easily loaded and unloaded by means of overhead hoists. The blast chamber is completely enclosed during blasting operations. Since it will handle practically any shape or size of work up to a certain limit, it has become a handy tool for the jobbing foundry.

High Production Equipment Designed

Its principal disadvantage lies in the fact that it is intermittent in operation because of the necessity of shutting off the abrasive flow when the door is opened. However, this disadvantage can be corrected by means of the twin-table, where one table is being loaded while the other is in the blast chamber. In all table machines at least two passes are generally required to thoroughly clean the work on all sides. Where over-all cleaning coupled with high production is required, a specially designed cabinet may be preferred.

Special Designs: As the name implies, the special cabinets are designed specifically to handle a certain problem, and include a virtually unending list of different handling methods. One of the most common of these uses a monorail conveyor to carry the work through the blast zone. The work hangers on the conveyor may be rotated as they pass through the blast. In some cases they may stop and index in order to allow additional cleaning time. This type of equipment offers extremely high production rates at low cost and facilitates the cleaning of unusually shaped pieces such as bath tubs and cylinder blocks.

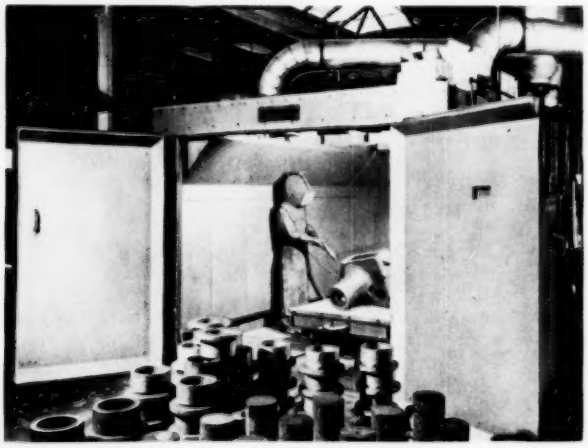
Another continuous-type machine is a variation of the tumbling barrel which permits the work to pass through the machine in a continuous flow. Employing a continuous belt conveyor similar to that described earlier, the work is fed in at one end and is tumbled under the blast stream as it passes, by gravity, through the machine to discharge at the other end. The continuous airless blast tumbling machine permits continuous, automatic operation from shakeout through cleaning, sorting and chipping to shipping room.

Rooms and Cabinets: This type of equipment is generally found in airblast installations. The room consists of a large covered framework equipped for adequate ventilation, and with a hopper arrangement for removing scale, sand and abrasive and then recovering the usable abrasive. The room is generally used for extremely large work which cannot be conveniently handled in a specially designed cabinet and is not produced in quantities sufficient to justify the cost of specially designed, heavy-duty handling equipment.

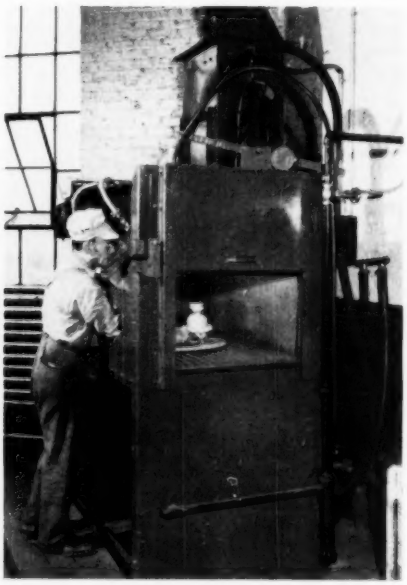
Where small numbers of small pieces are to be cleaned by airblast, they are frequently handled in small cabinets where the operator can stand outside the blast chamber and handle the parts manually. His hands and arms extend through apertures in the cabinet wall and are usually protected by rubber gloves.

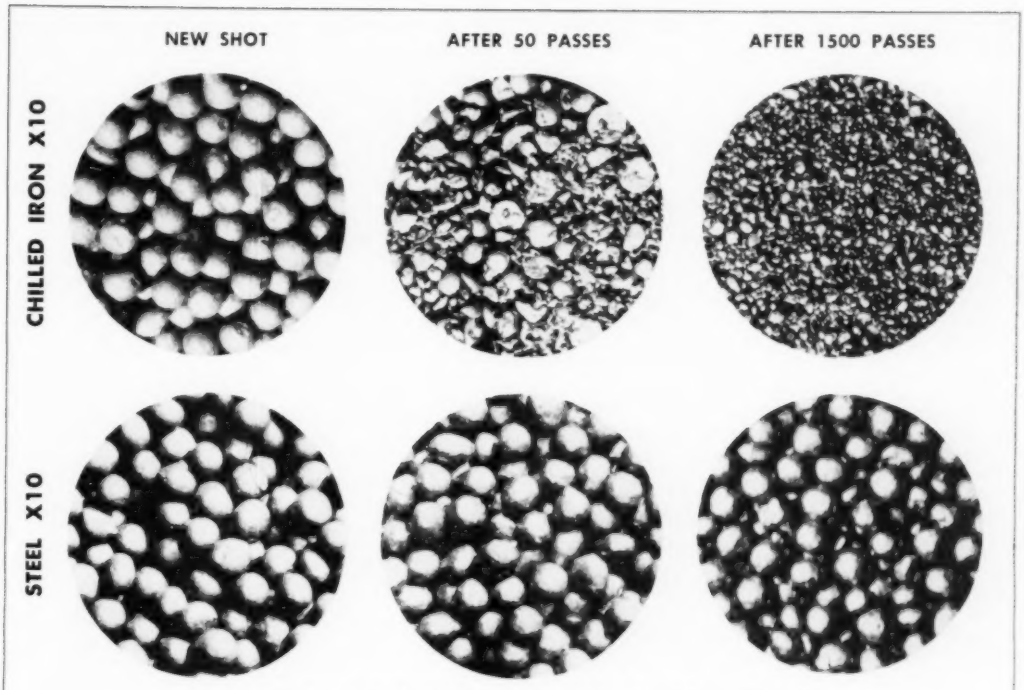
Accessory Equipment: Aside from the basic machine required for handling the work and propelling the abrasive, certain accessory equipment is always re-

A view of a sandblast cabinet showing the operator in working position. Used abrasive falls through a floor grating for collection and re-use.



The operator is preparing to clean a small water meter assembly in an airblast cabinet. Rubber gloves protect operator's hands from the blast.





Cast iron and cast steel shot are compared for breakdown rates after a given number of passes through a centrifugal blasting wheel. X10.

quired. It generally includes a hopper arrangement which gathers up the abrasive, sand and scale and delivers it to a central location from which it is conveyed by means of screw conveyors and elevators to the abrasive separator. This separator is a device employing the principle of air flotation to separate the sand and broken abrasive from the whole, re-usable shot or grit.

In blast cleaning, whether it be airless or airblast, considerable quantities of dust are created from the breakdown of the scale, sand and abrasive. Adequate ventilation and a good dust-collector system are necessary to prevent this dust from becoming a nuisance in the working area.

Abrasive: The list of available abrasives is long, and new ones are constantly being added for specific purposes. In general, the only abrasives that foundrymen are interested in are the non-metallic (sand, silicon carbide, aluminum oxide, etc.) and the metallic (chilled iron, malleableized iron, steel or copper). The metallic abrasives are by far the most popular because their long life and low equipment wear offers much more economical operation. Sand, even when present in small quantities as a result of inadequate separation, has an extremely serious effect on the life of any of the parts in the blast zone.

If full advantage is to be taken of the economies offered by the metal abrasives, care must be exercised to eliminate loss through carryout or leakage from the machine as well as the presence of sand in the circulating abrasive load. This becomes especially important in the case of the premium abrasives such as steel or copper shot. These materials offer greatly reduced wear on the equipment and low shot consumption, even when compared to the other metallic abrasives, but all of the advantages they offer can be nullified by careless operation of the equipment.

In any description of airless blast equipment the importance of sturdy construction and the generous use of heavy, replacable liner plates to protect the cabinet itself from excessive abrasive wear should not be overlooked. Although heavy construction means a somewhat greater initial investment, the maintenance economies it offers far outweigh the first cost.

Even though the cabinet walls are of heavy ¼-in. plate, they should not be subjected to any concentrated abrasive blast. Once a hole has been worn through the cabinet wall a whole section must be replaced or unsightly patches tacked on. It is easier and far less expensive to hang ½-in. or ¾-in. liner plates over areas subject to wear.

To summarize briefly the relative advantages of the different cleaning methods, we may say that airless blasting offers thorough cleaning at lowest cost where reasonably large production is involved. In cases of specific jobs, each of the other cleaning methods offers distinct advantages which must be balanced against their inherent disadvantages. This can be done only by the foundryman in the light of his own needs.

MODERN FOUNDRY METHODS...

BAND-SAWING NON-FERROUS CASTINGS

The application of bandsawing methods in the cleaning of non-ferrous castings is discussed by H. J. Chamberland, research engineer, The DoAll Co., Des Plaines, Ill. In a previous paper, "Friction Saw Cuts Casting Cleaning Cost," AMERICAN FOUNDRYMAN, June, 1949, he dealt with the friction sawing of ferrous castings.

Non-ferrous metals are not in the friction sawing category, and any cutting operation on aluminum, magnesium, copper, brass or bronze castings is one of actual sawing, whether the blade velocity is 5000 or 100 fpm. The saw velocity depends to some extent on thickness of cut, but particularly on the composition and hardness of the material, bearing in mind that those having abrasive characteristics are the most detrimental to saw life. Only through proper control over velocities, and at times the use of a lubricant, can the most economical relationship between cutting rate and blade life be established.

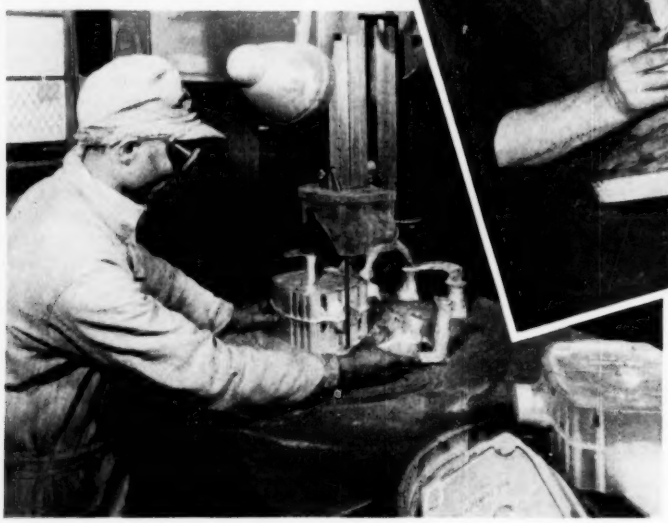
Two types of sawbands are effective in cutting non-ferrous metals. On aluminum and magnesium the buttress type of saw is usually preferred. On sections under $^3/_8$ in. a standard pitch band is recommended. The buttress saw has widely spaced teeth and provides coarse tooth construction to narrow contour sawing bands with maximum chip clearance for free and cool cutting action. Copper alloys are handled efficiently by a standard pitch band. Both bands are of the precision type—the teeth are hardened to resist long cutting periods under most severe conditions. Material thickness in the case of non-ferrous castings is not a factor and is limited only by machine sawing height capacity.

Aluminum sheets, plates, bars and extrusions are seldom cut at conventional speeds since the high-speed technique is from three to six times more productive. However, such types of aluminum alloys as 14ST have abrasive characteristics and render high speeds impractical in favor of blade life.

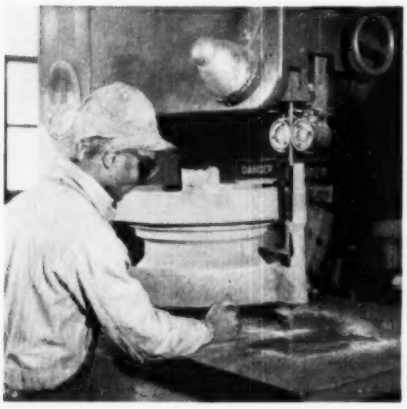
When cutting at low speeds feeding pressure is important and should be only medium at the most, preferably under hydraulic work-feed control for the forming of comparatively heavy chips.

Most magnesium castings are cut at high velocities and cutting rates compare favorably with results on aluminum. A factor worth considering in high-speed bandsawing is that a particular velocity will serve for a far greater material thickness range than do conventional speeds. On both aluminum and magnesium casting sec-

Aluminum castings, unless the silicon content is high, cut considerably faster at high speeds. In this case work section is only ½ in. and, since a contour is involved, the gates and risers are cut with a standard ½ in.-6 pitch band at 4000 fpm.



The buttress type of sawband is by far more productive for cutting aluminum sections over ½ in. thick. In this instance a ¾ in.-3 pitch buttress band is operating at 3400 fpm on a ⅞-in. cut.



Height of cut with these magnesium risers is 2¼ in. This is also a contour cut, requiring a standard ½-in. band but of 10 pitch to improve the finish. Saw velocity is 400 fpm.

Cutting risers from 157-lb red brass casting. Height of cut is 3 in., requiring a standard 1 in.-6 pitch band at 300 fpm. With a material thickness of approximately 1 in., saw velocity could be increased to 900 fpm.

tions, for example, the recommended velocity of 3500 fpm for a ½-in. thickness drops only to 2600 fpm for a 6-in. or thicker section, and this could be standardized at 2800 and 3200 fpm. Under conventional sawing speed procedure, at least six changes in velocities would be required to cover this material thickness range.

Magnesium may be sawed dry, but lubricating the blade with a tallow stick aids in cooler cutting; the tallow need be applied only before each cut or number of cuts, depending on circumstances.

Few of the copper alloys are cut at speeds exceeding 400 fpm. Hardness and sawability vary with the analysis of the alloy; as hardness increases the velocity must be decreased, but the decrease is not necessarily proportional to increased hardness. As the alloy becomes more complex from elements added to increase tensile strength and shock resistance, saw velocity must be decreased.

Lubricants are recommended when chips show a tendency to weld to the saw teeth, especially when cutting high-silicon and high-manganese bronze gates and risers. Feeding pressures vary with hardness and work height; a feeding pressure of 25 lb generally applies to a 1-in. thickness. As the material shows resistance to tooth penetration work pressure must be adequately increased or the teeth will have a tendency to glaze over the surface. With the application of the proper saw control factor, chip formation on non-ferrous materials should not be different than when cutting steel. Flaked chips usually denote a too high velocity.

The only non-ferrous castings that can be cut at rather high speeds are those heavily predominating in copper and entirely free of manganese, silicon, and

BANDSAW—MAGNESIUM CASTINGS

Application Part	Cut, in.	Saw Selection Size, in.	Pitch	Saw Velocity, fpm	Cutting Rate, sq. in./min
Section (contour)	8	1/4	4 (buttress)	3200	19
Riser	4 3/4	1	3 (buttress)	3600	24
Riser	2	1	4 (buttress)	3800	30
Riser	1	1	6 (standard)	4000	50

BANDSAW—ALUMINUM CASTINGS

Application Part	Cut, in.	Saw Selection Size, in.	Pitch	Saw Velocity, fpm	Cutting Rate, sq. in./min
Gate[1]	1	1/2	4 (buttress)	3800	30
Gate[1]	2 1/2	1	3 (buttress)	3400	27
Riser[2]	3	1	3 (buttress)	2000	23
Section[2]	9	1	2 (buttress)	3000	18
Gate[3]	2 1/4	1	6 (standard)	800	4
Section[3] (contour)	2	1/2	6 (standard)	400	9
Riser[3] (contour)	4	1/2	6 (buttress)	200	6

[1]Silicon free
[2]Low silicon
[3]High silicon

nickel. Most gates and risers, not thicker than 1 in., of beryllium copper or 90-10 brass, will cut efficiently at 2000 fpm with a ½ in.-4 pitch buttress band. On sections under ½ in., either a 6-pitch or 10-pitch band should be used, with the 10 pitch applying to a thickness under ¼ in. Velocity of 2000 fpm is exceptional, and must be dropped substantially with any increase in thickness.

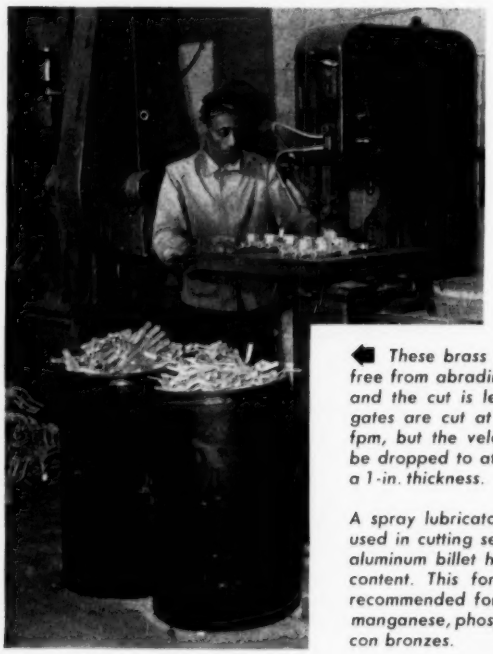
Cartridge brass and bronze having high lead and tin contents will cut well at a velocity of 1000 fpm, preferably with a standard band of pitch to suit. A 2000-fpm velocity exceeds the maximum of the low-speed range by only 500 fpm. A velocity of 1000 fpm is obviously high, when speaking of low speed sawing, and from here on velocities drop to 400 fpm and as low as 100 fpm for cutting thick sections of high-silicon bronze.

BANDSAW—COPPER-BASE ALLOYS

Material	Application Part	Cut, in.	Saw Selection Size, in.	Pitch	Saw Velocity, fpm	Cutting Rate, sq. in./min
NO LUBRICANT						
Brass (70-30)	Gates	3/4	1/2	4 (buttress)	2000	0.015 min/cut
Red Brass	Gates	1	1	6 (standard)	1000	1.47
Bronze (1% Si)		1	3/4	6 (standard)	500	4.0
Brass (70-30)	Gates	5/8	3/4	10 (standard)	300	9.0
Aluminum Bronze	Section	1 1/4	3/4	10 (standard)	100	6.0
Naval Brass	Gates	7/8	7/8	4 (buttress)	1000	17.0
Manganese Bronze	Section	1 1/4	3/4	3 (buttress)	250	4.7
WITH LUBRICANT						
Manganese Bronze	Risers	6	1	2 (buttress)	100	1.8
Silicon Bronze	Risers	4	3/4	8 (standard)	200	1.2
Manganese Bronze	Risers	2	1	3 (buttress)	150	4.6
Phosphor Bronze	Wheels	3/4	3/4	10 (standard)	500	5.5
Silicon Bronze	Section	1 1/4	1	8 (standard)	150	3.0

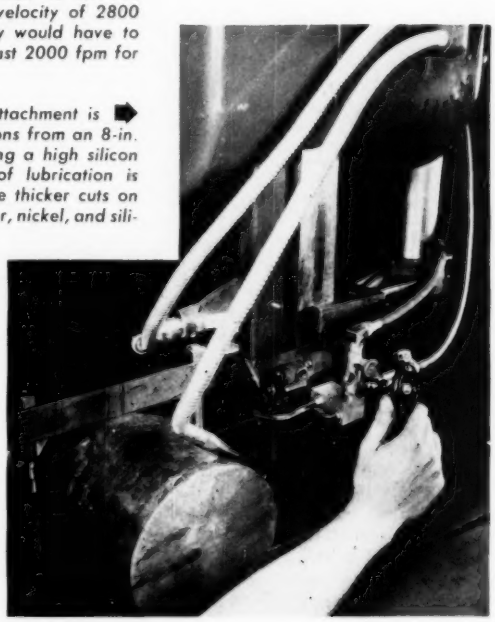
soluble oil. A quart of the mixture will last for about 3 hr when sprayed directly at the point of saw-work contact under a 40-lb pressure.

Materials, their saw control factors and cutting rates to be expected therefrom are listed in the tables. These compilations should be accepted on a theoretical basis, as only when all factors have been thoroughly analyzed can the most efficient bandsaw technique be established.



These brass castings are entirely free from abrading alloying elements and the cut is less than ⅜ in. The gates are cut at a velocity of 2800 fpm, but the velocity would have to be dropped to at least 2000 fpm for a 1-in. thickness.

A spray lubricator attachment is used in cutting sections from an 8-in. aluminum billet having a high silicon content. This form of lubrication is recommended for the thicker cuts on manganese, phosphor, nickel, and silicon bronzes.



The following types of materials are usually cut dry:

Copper, 99.9	Brass, 70-30
Low Brass	Cartridge Brass
Red Brass	Leaded Brass
Spring Brass	Naval Brass
Aluminum Brass	Beryllium Copper
Manganese Bronze (1% Ni—1% Si)	Low Silicon Bronze (1% Si)

If and when some form of lubrication is desired, either the drip method at the rate of 60 drops of cutting oil per minute, or the spray system with the correct proportion of soluble oil and water can be applied. Spray lubrication is most economical in the long run even if high in

COLORIMETRIC DETERMINATION OF ALUMINUM IN STEELS

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A rapid and accurate colorimetric method is proposed for the determination of aluminum in steels. A composite aluminon reagent [1,2] is used. The method has been in use in this laboratory for 10 months, and has proved entirely satisfactory.

Apparatus and Reagents

Klett-Summerson photoelectric colorimeter with 540-millimicron filter and 4-cm cell.

Benzoic Acid Solution (10 per cent): Dissolve 50 grams of benzoic acid in 500 ml of methanol.

Buffer Solution: Mix 470 ml of ammonium hydroxide (29 per cent) and 430 ml of glacial acetic acid. Cool to room temperature and add more acid or base as necessary to adjust the pH from 5.25 to 5.35 when diluted 1 to 20. Dilute to 1 liter.

Gelatin Solution (1 per cent): Dissolve 3 grams of gelatin by adding hot water and stirring. Cool and dilute to 300 ml.

Aluminon Reagent: Dissolve 0.3 grams of high purity aluminon in 200 ml of water and add 60 ml of benzoic acid solution (10 per cent). Dilute to 300 ml. Add 300 ml of buffer solution and 300 ml of gelatin solution and shake. The aluminon reagent should stand 3 days before using. The reagent was found to be stable for at least 2 months if stored in the dark.

Procedure

For steels containing less than 0.15 per cent aluminum use a 1-gram sample; for steels containing more than 0.15 per cent aluminum use a 0.1-gram sample. Transfer the sample to a 250 ml Erlenmeyer flask and dissolve with a mixture of 8 ml of hydochloric acid (38 per cent) and 8 ml of nitric acid (70 per cent). Add 8 ml of perchloric acid (70 per cent) and heat until the perchloric acid refluxes and the silica is dehydrated.

Add 80 ml of water, filter through a medium texture filter paper and wash with 1 per cent sulphuric acid solution. If total aluminum is required, ignite the filter paper and precipitate, treat with sulphuric and hydrofluoric acids, re-ignite, and fuse with 0.5 gram or less of sodium bisulphate. Dissolve the melt in water and combine with the main solution.

Electrolyze in a mercury cathode cell until the iron is removed. Filter the electrolyte through a rapid filter paper. Dilute to 200 ml in a volumetric flask and pipette a 5 ml aliquot into a 100-ml volumetric flask. Thoroughly mix the aluminon reagent and add 15.0 ml (± 0.5 ml) with a pipette. Do not allow the aliquot or aluminon reagent to run down the neck of the flask.

Heat for 20 min on the steam bath in such a way that the steam comes in contact with the sides of the flask, cool in a running water bath for 5 min, dilute to 100 ml with water and shake. Within 2 hr compare the solution against a reagent blank at 540 millimicrons in the photoelectric colorimeter. A reference table for percentages is prepared by the use of standard aluminum solution or National Bureau of Standards samples.

Table I shows the results obtained on several National Bureau of Standards samples.

The authors wish to express their appreciation to W. L. Miller for his helpful suggestions.

TABLE I—ALUMINUM DETERMINATIONS ON NATIONAL BUREAU OF STANDARDS STEEL SAMPLES.

Sample	Al Present (total), %	Al Found (total), %
106	1.06	1.05
		1.04
		1.06
		1.07
125	0.261	0.27
		0.28
13c	0.019	0.019
33c	0.033	0.030
		0.030
		0.032
		0.032

1. C. H. Craft, and G. R. Makepeace, *Industrial Engineering Chemistry, Anal. Ed.*, 17, 206 (1945).

2. J. Carroll, I. Geld and G. Norwitz, AMERICAN FOUNDRYMAN, p. 43, Nov., 1949.

NOTE: The opinions expressed in this article are those of the authors and are not to be construed as representing the official views of the Navy Department.

Gray Iron Research Operators Group Meets To Discuss Cupola Operation

SEVENTY REPRESENTATIVES of the Operators Group of the 16-foundry Gray Iron Research Institute met January 26 and 27 in Columbus, Ohio, to discuss the organization's cupola program and quality control of gray iron castings. Under study in a cupola at Battelle Memorial Institute are the relations between blast temperature and blast humidity.

Officers of the Operators Group are: J. E. Reynolds, U.S. Pipe & Foundry Co., Bessemer, Ala., chairman; Erwin Deutschlander, Worthington Pump & Machinery Corp., Buffalo, N. Y., vice-chairman; and H. W. Lownie, Battelle Memorial Institute, Columbus, Ohio, secretary.

Gray Iron Research Institute officers are: C. R. Culling, Carondelet Foundry Co., St. Louis, president; E. B. Sherwin, Chicago Hardware Foundry Co., North Chicago, Ill., vice-president; E. C. Hoenicke, Foundry Div., Eaton Manufacturing Co., Detroit, Mich., secretary; and Walter A. Kramer, Advance Foundry Co., Dayton, Ohio, treasurer. The Research Committee which reviews work in progress and develops the research program is headed by Charles F. Seelbach, Forest City Foundries Co., Cleveland. D. E. Krause, executive director of the Institute, coordinates activities of the committee.

PRINCIPLES OF GATING DESIGN

factors influencing molten steel flow from finger gating systems

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and
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THIS INVESTIGATION is part of a program to evaluate the fluid flow characteristics of molten metals in sand molds in order to evolve principles generally applicable to the design of gating systems. A previous report[1] showed that many gating systems do not function as commonly supposed. The present report entails a study of factors which influence the uniformity of discharge of molten steel into a mold cavity through multiple openings in a horizontal plane, as in finger gating systems, or which determine the sequence of flow through openings arranged in a vertical plane, as in step gating systems.

These studies are based on observations of the discharge of the molten steel into the mold cavities as recorded by motion photography. The most instructive scenes have been assembled into two 16 mm colored sound films, "Finger Gating" and "Step Gating."

Experimental Procedures

Molten steel was poured at 3000 F into both finger gating and step gating systems. The flow and appearance of the metal as it emerged from the gates were recorded by 16 mm kodachrome cinephotography at 64 frames per second. The luminescence of molten steel permits photographing the flow behavior from directly above the mold without artificial lighting.

Studies were made in this manner of flow in finger gating systems having a finger to sprue area ratio of two to one. The flow was observed in runners designed to split the stream; in runners bent toward or away from the casting; in tapered runners; in runners designed so that the molten metal impinged upon itself; and in runners having enlarged sections or pools.

Metal flow was observed in step gate systems having each step separately joined with the sprue; systems with two or more steps in common junction with the sprue; systems which incorporated tapered sprues or reversed sprues; and systems having steps combined with pools and offsets. The photographic technique employed in this study did not permit continued observation of the feeding from a step after the rising metal had passed that step; consequently, it was possible to determine only if the steps fed in sequence when reached by the metal.

Unless noted otherwise in the text the dimensions of the components of the gating systems studied were: (1) sprues and steps, 1 in. in diameter; (2) runner, 1 in. wide by 1 in. deep and rounded on the bottom by a radius equal to one half of the width; and (3) fingers, same shape as the runner with the appropriate dimensions.

In the step gating systems the steps were located 6 in. apart vertically. The casting used in the finger gate studies was a 6x12x6-in. section cast horizontally, while in the step gating studies, a casting 18 in. high, tapering from 6x6 in. at the top to 4x4 in. at the bottom, was cast vertically. A plugged pouring cup was employed throughout, since previous work with high speed photography (1000 frames per second) showed that such a cup maintained more constant conditions.

The following sections are devoted to generalized

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Fig. 1A

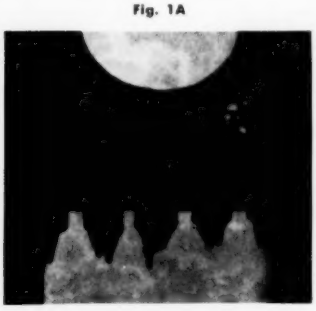
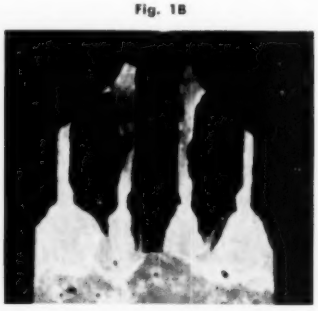


Fig. 1

Fig. 1B



observations and analyses of flow through the various gating systems.

Flow in Finger Gating Systems

Split Stream Runners: The gating system shown in Fig. 1 was so designed that the runner-finger intersections would act to split the runner stream into equal parts and thus force uniform feeding. In this system all the fingers fed practically from the beginning of pouring as shown in Fig. 1A. The flow through the finger was intermittent rather than steady. A rocking movement back and forth on the surface of the steel with absence of either swirling or rolling motion was observed,* probably due to the intermittent feeding.

For better observation of the flow in the fingers, the cope of the mold was removed, Fig. 1B. The intermittent nature of the flow is evident in the middle fingers. The absence of the cope affected the flow in that a greater quantity of metal entered through the outer fingers than was the case with the cope present.

Bent Runners: The four gating systems of Fig. 2 were designed to determine the effect on flow of changes in angle at the junction of the runner and fingers. With both ends of the runner bent back 45° from the casting, most of the feeding during the very early stages was through the outer fingers, Fig. 2A, producing swirling turbulence. A change to uniform flow conditions soon occurred as indicated by the development of rolling turbulence.

With the runner bent back only 30°, it was again observed that the initial feeding occurred through the outer fingers, Fig. 2B, resulting in swirling turbulence, while the outer fingers continued to feed most of the metal, as indicated by the persistence of swirling motion. Runners bent forward at angles of either 45° or 30°, Figs. 2C and 2D, caused the outer fingers to do almost the entire feeding in the early stages of pouring. Uniform flow was obtained late in the pouring when the runner was bent at an angle of 45°, but swirling turbulence prevailed throughout when the angle of the runner was only 30°.

The system shown in Fig. 3 was designed to evaluate bent runners in connection with offset sprues. The runner in this case was placed at an angle of 45° to the casting, and it is seen that initially the farthermost fingers fed more strongly. Later, feeding became uniform through all fingers, as indicated by the rolling motion of the metal in the casting.

Tapered Runners: The gating systems of Fig. 4 were designed to study the effects of tapered runners. The width and depth dimensions (square cross section) of the first system tapered from 1 in. to ¾ in. The sprue was located on the larger end. Initially, flow was stronger through the outer fingers, Fig. 4A, but uniform flow occurred later as indicated by rolling turbulence.

A taper modification to a ¼ in. (width and depth) at the small end produced a more uniform first flow, Fig. 4B, but not sufficiently so to completely prevent initial swirling turbulence. Uniform flow was developed later as manifested by rolling turbulence.

Figure 4C shows the initial flow in a gating system in which the runner was step-tapered so as to reduce

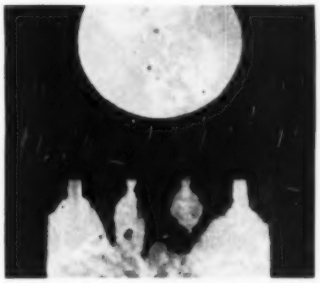


Fig. 2D

Fig. 2

Fig. 2A

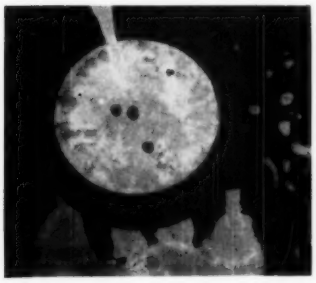


Fig. 2B

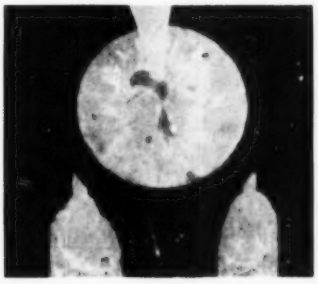
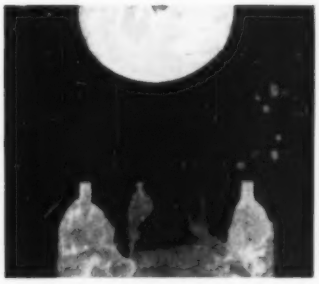


Fig. 2C



* For purposes of this report, mold turbulence has been differentiated into three types:

(1) Swirling—Caused by non-uniform flow; the axis of rotation being perpendicular to the surface of the metal and to the plane of the fingers.

(2) Rolling—Produced by uniform flow and characterized by a uniform flow on the surface of the metal from one side to the opposite; the axis of rotation of metal within the mold being horizontal and parallel to the plane of the finger and to the runner.

(3) Rocking—Produced by intermittent discharge and characterized by rocking back and forth of the metal in the mold.

the volume abruptly at each finger junction. The overall taper varied from 1 in. at the sprue to 3/8 in. at the end. The nearer fingers fed most strongly at first; later the farther ones carried the greater quantity of metal, and finally, as the mold cavity filled, the feeding became uniform causing the turbulence to change from swirling to rolling.

Impinging Runners: These runners were designed to effect a reduction of momentum by the collision of two metal streams. The arrangement shown on the left in Fig. 5 resulted in greater flow through the inner fingers, Fig. 5A. Uneven flow occurred during most of the pouring, changing to uniform flow only at the final stages of pouring.

Figure 5B shows the initial flow from an impinging runner design having an enlargement at the point of impingement. This enlarged section was added so

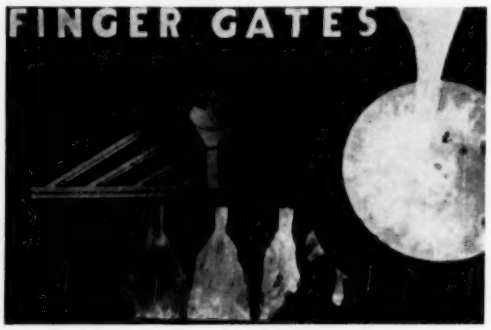


Fig. 3—Designed to evaluate bent runners in connection with offset sprues, the runner in this system is placed at an angle of 45 degrees to the casting.

that the pressure wave generated at the point of collision could be dissipated. In this system, the inner fingers did most of the initial feeding, but uniform flow was established soon thereafter.

Enlarged Runners: Figure 6 shows gating systems designed to permit the metal to reduce its momentum in an enlarged runner; while Fig. 6A shows the effect of a single large pool. This system produced slightly uneven flow at first (emphasis is on farther fingers), but by the time the bottom of the mold was covered, all fingers fed uniformly and rolling turbulence resulted from the uniform flow.

Figure 6B shows a system with a runner enlargement in the drag in order to form two separate, vertical pools. This system produced a slower and uniform flow almost from the start of pouring which prevailed as the mold was filled.

Figure 6C shows a runner with two enlarged sections in the horizontal plane. With this arrangement flow was principally through the outer fingers as indicated by the swirling turbulence which continued throughout pouring. Reversing the pool as in Fig. 6D, in order to turn the flow away from the casting, resulted in some unequal feeding at first which later changed to uniform flow. With the cope removed, it was observed that the metal first swirled in the pools, lost part of its momentum and then flowed out fairly uniformly into the casting cavity.

Summary of Flow in Finger Gates: Figures 1 through 6 show that it is possible to obtain uniform flow in "non-choking" finger gate systems, i.e., systems having a total finger area greater than the sprue area. This can be done by the use of gates which either split the fluid stream into equal parts or which absorb the momentum of the stream. The absorption of momentum can be best obtained by the use of pools in the runner and with lesser success by either bending the runner away from the casting, or tapering the runner.

Flow in Step Gating Systems

Inasmuch as single photographs are not descriptive of the flow in step gating systems because of the continuously rising metal, a recourse was made to schematic representation of the chronological details shown by the film. These are presented as Figs. 7 to 11. The position of the arrowhead on arrows emanating from the upper steps indicate the level of metal in the mold when flow started from the step in question.

The inclination of the arrow from the bottom step indicates the path of the first flow from that step. The flow desired in step gating, termed sequence flow, is a relatively strong but quiet flow from each step as the metal level reaches it. Dribbling is not desirable because of the possibilities of sand erosion and the formation of cold shuts.

Single Junction Steps: The first system, Fig. 7A, was used as reference since it represents the most commonly used system. With this system all of the feeding was accomplished by the bottom step. Metal ran back into the middle and top steps. The remainder of the systems in this series are modifications of this basic system based on reversing or steeply inclining one or more of the steps.

In order to reduce the predominance of the feeding by the bottom step, this step was inclined upwards 60° from the horizontal, Fig. 7B, thus simultaneously increasing the length of the step and introducing a sharp angle which offers more resistance to flow. This change produced sequence flow from the middle step but not the third. Inclining both of the two lower steps, Fig. 7C, did not produce sequence flow and moreover caused premature feeding from the middle step.

Design for Sequence Flow

Figures 7D, 7E, 7F show systems aimed at producing sequence flow with steps which curve downward from the sprue, and with curved steps in combination with inclined steps.

The first gating system, Fig. 7D, illustrates a continuous step gate which is sometimes used commercially. It is claimed that in such a gate the first metal will follow the contour of the gate and subsequent incoming metal will be deflected by the metal in the gate so that feeding occurs at continuously higher levels during pouring. However, this gate acted to deflect the metal to the bottom of the mold cavity throughout pouring. The second system, Fig. 7E, divided the continuous gate into three steps but was not successful insofar as the top step was concerned.

Combining steps that curve downward from the sprue with reversed angles, as in Fig. 7F, produced lim-

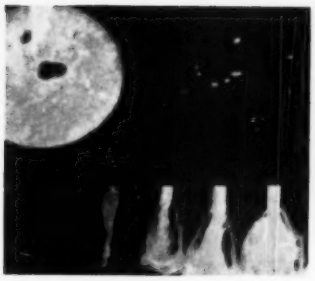


Fig. 4A

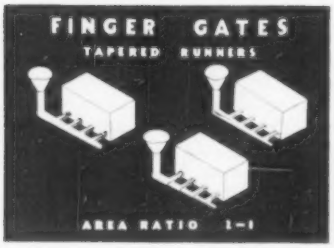


Fig. 4

Fig. 4B

ited sequence flow from all three steps. However, dribbling occurred from the curved steps prior to flow. In order to eliminate dribbling, the middle step was changed from a downward curve to a straight gate inclined upward 30°, Fig. 7G.

With this system the bottom step discharged metal forcibly when pouring started; the middle step did not dribble, but fed when the metal level reached it; the top step, however, still dribbled, but fed in sequence when the metal level approached it. Thus limited sequence flow can be obtained from a three-step system when the top step is curved downward and the lower steps are inclined upward.

Tapered Sprues: The next series of gating systems, Fig. 8, shows the effect of tapering the sprue. The straight step gating system, Fig. 8A, is used as reference. Flow through gates attached to sprues which had a direct taper (from 1 in. at the top to ¾ in., ½ in. and ¼ in. at the bottom, Figs. 8B to 8D, respectively) was sequential to a limited extent only for 1-in. to ¾-in. taper. The more severe tapers resulted in almost simultaneous flow through the three gates.

Sprue Taper Critical

The first reverse taper system, Fig. 8E, was a big-end-down sprue tapered from a 1-in. diameter at the top to 4 in. at the bottom. This system was not successful. A milder reverse taper system, Fig. 8F, had the sprue tapered from 1-in. diameter at the top to only 2 in. with a pool at the bottom. Again the system was not successful.

These experiments corroborated the deductions relative to the finger gates; namely, the amount of sprue taper necessary to produce the desired flow pattern is critical and would be difficult to control. Reverse tapers (which may also be considered enlargements) show, as in finger gates, that the use of enlargements decreases the momentum of the incoming metal but not sufficiently to produce the desired sequence flow in all cases.

Common Junction Steps: Figure 9 shows the use of a novel system of slanting two or more of the steps upward from a common junction at the sprue. Figures 9A, 9B and 9C show gate systems with all three steps radiating from a common junction. In the first two, limited sequence flow was obtained through only the lower two steps. In the third, Fig. 9C, for which the angle of inclination of the lower step was 60°, metal ran back into the top step at first, but later an indication of weak flow from this step was apparent.

In attempts to improve the flow from the top step, the second group of gating systems, Figs. 9D through

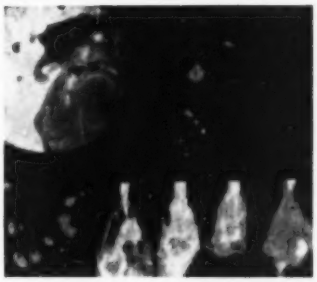


Fig. 4C

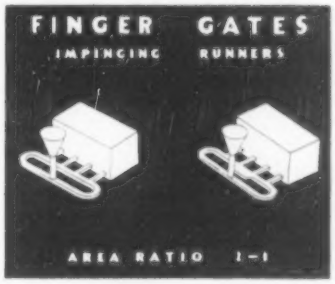


Fig. 5

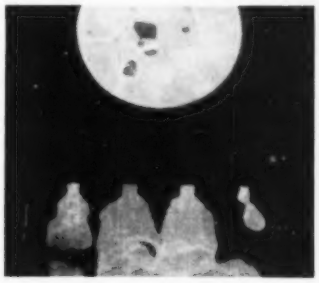


Fig. 5A

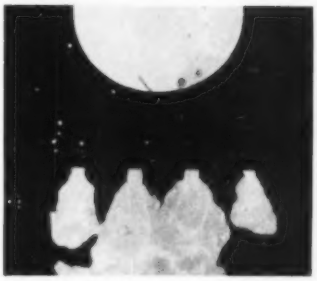


Fig. 5B

9F, had only the two lower steps joined at a common junction. The top step was divorced because it was believed that the flow distance in the top step from the multiple junction to the point of entry at the casing was too great to permit the desired flow. With the top step set horizontally, Fig. 9D, feeding was slightly better through this step than in the systems of 9A to 9C, but it was still very weak.

Inclining the top step 30°, Fig. 9E, did not produce better results. A beneficial effect on the flow, however, was produced by inclining the top step 60°, as in Fig. 9F. The lower steps fed in order, and although at first metal ran back into the top step, strong surface turbulence later indicated that this step was functioning properly.

Figures 9G through 9I show a change in the location of the junction point so that only the upper two steps are connected. The bottom step was retained steeply inclined upward at 60° for comparison with Fig. 9C. In the first system, Fig. 9G, with the middle step parallel to the bottom step, strong initial flow occurred at the bottom step and sequential flow was obtained from the middle step, but metal ran back into the top step.

Common Junction Step Angles

Changing the angle of the middle step to 45° and to 30°, Figs. 9H and 9I, respectively, progressively improved the flow from the top steps. Although metal ran into the top steps at first, flow soon occurred from these in sequence; flow from the bottom steps was still strong. In order to decrease the jet effect of the flow from the bottom step the step was inclined only 45°, Fig. 9J. Sequence flow with reduced force from the bottom step resulted.

The systems in Fig. 9 show that (1) with proper design the desired sequence flow occurred from all three steps; (2) that the bottom step must be inclined so that after the first flow occurs preference for the continuance of flow through this step is decreased; and (3) that the most satisfactory sequence flow from the upper two steps is obtained when these steps radiate from a common junction.

Reversed Sprues: The functioning of step gating systems with reversed sprues is shown in Fig. 10 using the common "saxophone" or "trombone" type of gate. In the first system flow was obtained from all three steps, but dribbling and premature flow occurred from the middle step. In order to reduce the momentum of the metal stream, which was believed the basic cause of such premature feeding, enlarged sections, Figs. 10B and 10C, replaced the bend in the sprue.

In the system of Fig. 10B the bottom step fed quietly and the top step correctly, but the middle step fed early. To overcome premature feeding from this step, the reversed sprue portion was enlarged to a 2-in. diameter at the base and tapered to a 1-in. diameter at the top, Fig. 10C. The bottom step again fed very quietly. The middle step began to feed at a later time than before, and the top step fed in sequence.

These systems show that sequence flow in step gates as in the case of finger gates can be obtained most readily by devices which dissipate the momentum of the incoming metal without producing localized pressure zones at the ingate junctions.

Pools and Offsets: Various systems were studied in which pools or offsets were used, Fig. 11. It was thought that momentum effects could be eliminated by such means and sequential feeding obtained. However, pools caused strong premature feeding from the top step and flow was only occasionally observed from the lower steps. These tests indicated that the use of pools or offsets does not, per se, produce sequence flow.

Summary of Flow in Step Gates: The step gating systems in Figs. 7 through 11 show that sequence flow can generally be obtained by designs that absorb the momentum of the fluid stream or reverse the direction

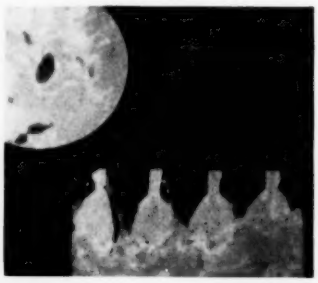


Fig. 6A

Fig. 6C

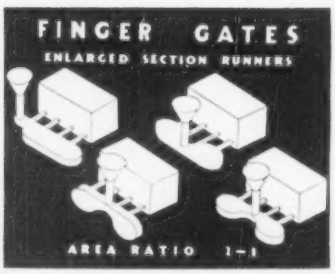


Fig. 6

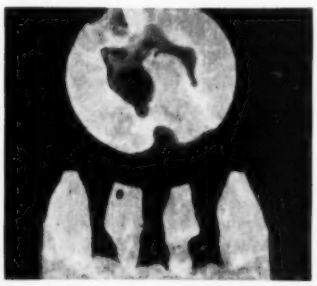


Fig. 6B

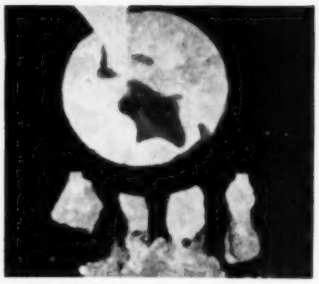


Fig. 6D

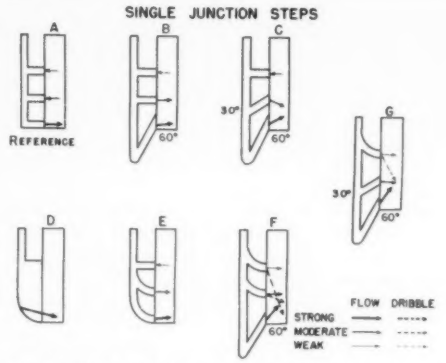


Fig. 7—The single junction gating system (A) and modifications (B, C, D, E, F) which are based on reversing or steeply inclining one or more steps.

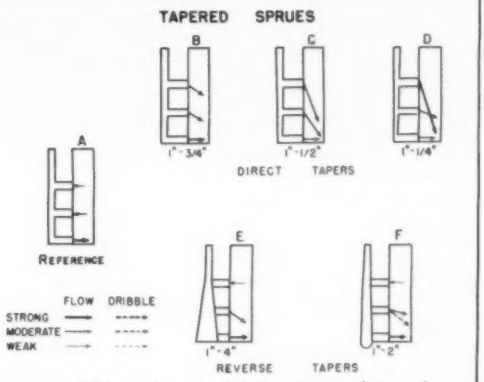


Fig. 8—This series of gating systems shows the effect of tapered sprues on the flow of metal.

of flow. Of the systems studied, sequence flow was obtained most readily by the use of common junction step gates, Fig. 9, and reversed sprue step gates, Fig. 10.

Generalized Hydrodynamics of Liquid Metal Flow: The gating of metal castings presents a complicated problem of fluid dynamics. In part, the flow of molten metal is that of a freely falling liquid under the influence of gravity. In part, it approximates the steady state flow of a fluid in a pressurized system. Both types of flow probably are always present in any fluid system, but to a different degree depending on various factors. Frequently turbulence may also be present.

It appears from the observations reported here that certain established concepts of fluid mechanics could be used to advantage by foundrymen in designing gating systems. Gating systems in present use indicate that the importance of momentum effects is not appreciated. A realization of the importance of these effects for fluids of high density, such as molten metals, is imperative for proper design.

From a strictly mechanical viewpoint, casting into a mold involves simply the transfer of metal from a position of high gravitational energy to one of lower energy. Inasmuch as energies may only be changed in form but not lost, it follows that the decrease of gravitational energy of high position must occur by transfer to other forms of energy. The relationships involved are strictly defined by the Bernouilli theorem, which is one of the basic and classic laws of hydrodynamics. This law states that any fluid has an instantaneous energy which is composed of three elements as follows:

$$Et = Mhg + \tfrac{1}{2}Mv^2 + PV$$

= energy of position + energy of momentum + energy of compressive elastic action

where E = energy; h = height of fall; g = acceleration due to gravity; M = mass; P = pressure; v = velocity; V = volume

Analysis on a basis that the flow of molten metals may be compared to the flow of water in the same channels is dangerous, even as a first approximation, for cases involving rapid flow. In these cases, such as shown for the initial entry of the metal along the empty channels, the velocity parameter of the $\frac{1}{2}Mv^2$ term (momentum) becomes the controlling factor of the equation since the pressure differential in incompletely filled channels is very low, and the PV term is therefore essentially zero.

Because of the importance of the momentum during the initial stages of pouring, it is reasonable to expect that the eightfold difference in the densities of water and liquid steel should result in a greater dependence of steel flow on momentum effects. For conditions involving slow flow in completely filled channels, described as pressurized systems, it should be expected that momentum effects would be of less importance. Accordingly, fluids of similar kinematic viscosity but with different densities should behave similarly in slow flow.

Sprue Phase of Pouring—Development of Momentum: A unit mass of metal flowing from the sprue to the mold through a distance (h) will lose an amount of potential energy (hg) and acquire a corresponding amount of kinetic energy Mv^2 (where $v = \sqrt{2hg}$), except for frictional losses, which represent nonreversible losses of energy by the system to the mold proper.

It should be understood that the total energy of the fluid system is finally converted to heat and transferred as such to the mold. The total height (h) is not measured from either the pouring hole in the sprue cup or the point of entry into the mold, but is measured from fluid level to fluid level. The important fact is that (h) decreases during the pouring operation while the liquid levels change as the mold fills and the sprue cup empties.

Once the plug is removed from the sprue cup, the metal begins to fall freely with accelerated motion. It should then fall in a stream of decreasing cross section in keeping with the well-known hydraulic relation:

$$Av = Q \text{ (constant)}$$

where (A) is the cross-sectional area. This expression follows simply from the incompressibility of the fluid and the constancy of volume. Since $v^2 = 2hg$, (A)

should change according to the relation derived below:

$$A = Q/v = Q/\sqrt{2hg}$$

The velocity increase developed during the course of flowing down the sprue should theoretically result in a decreased pressure leading to aspiration of air. The importance of such aspiration in metal casting is not clear. True aspirator action can exist only when the metal stream completely fills the top of the sprue. When the metal is falling freely, but not completely filling the top of the sprue, even though (v) is increasing, no true aspirator action is to be expected because the pressure (p) is necessarily equal to atmospheric.

However, it is extremely unlikely that the falling stream falls free and unimpeded. In all probability, it strikes and restrikes the sprue walls to produce turbulent flow. Thus it is possible that frequently what has been considered free fall of the metal is really a combination of free fall and turbulent flow. Under these conditions in vertical systems, considerable gas may be mechanically trapped, carried into the mold, and replaced by additional gas or air drawn into the gate by a pseudo-aspirator or entrainment effect.

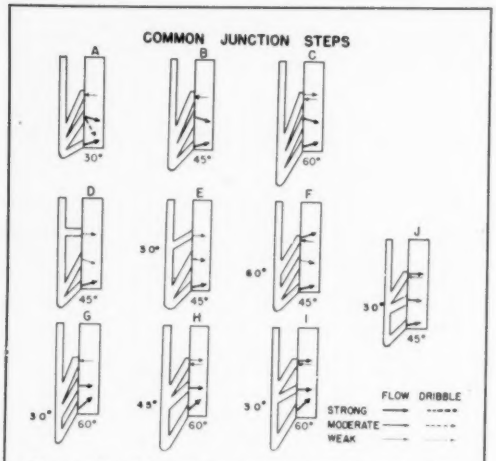


Fig. 9—In this system two or more steps slant upward from a common junction at the sprue.

Runner Phase of Pouring—Development of Pressure Zones: The metal after falling through the sprue and entering the runner takes the most rectilinear path available and travels with increasing velocity (gravitational energy converted to kinetic energy) along the empty runner until the end of the runner is met. This is particularly evident in finger gating systems. A pressure wave is then generated at the point of impingement (kinetic energy is changed to energy of elastic compression) causing the farthermost ingates to feed prematurely and forcibly. The pressure then builds up along the entire system and, depending upon the geometry of the system, other fingers begin to feed.

The flow patterns observed from bent runner systems in finger gates indicate that the geometry of the system is critical in determining the effects of the pressure zone built up at the end of the runner. With the runner bent back from the casting at 45°, the sharp change in direction at the junction of the fingers and runners causes increased flow resistance through the outer fingers, thereby producing uniform flow through all fingers.

When the runner is bent back only at a 30° angle, the change in angle of flow from runner to fingers is not sufficient to reduce appreciably the preferential flow in the outer fingers. The flow behavior observed when the runner is bent toward the casting is the result, at least in part, of splitting of the stream at the finger-runner junctions. In the case of the runner bent forward at an angle of 45°, this tendency is pronounced.

The use of enlarged sections or pools appears to be a most promising means of obtaining uniform or sequence flow. These devices permit the molten metal to lose a great proportion of the initial momentum without the generation of pressure zones and thus aid in producing uniform flow. Runner systems with impinging streams are apparently not as effective as others in producing uniform flow through finger gates because pressure wave effects are not eliminated.

Tapering may be used to control flow by frictional effects but its action appears to be more critical than the other methods explored in these tests.

Ingate and Sprue Areas

In most finger gating systems multiple ingates feed into the mold from a single downgate. It has been shown here that, in non-choking finger gating systems having the total area of the ingates greater than that of the sprue, the ingates do not normally feed uniformly and require special geometrical features to do so. Whenever the total area of the ingates is less than that of the sprue, the metal should be expected to back (choke) in the gating system and produce uniform feeding. Such conditions approximate those of theoretical steady flow in pressurized systems. Investigations of such systems are in progress.

Past designs of step gates apparently have been based on the anticipation of slow, even rise of metal and as such have ignored momentum effects. When the pouring conditions are predominately those of slow, steady flow, step gates might be expected to function most nearly as hoped. Under these conditions it would be expected that the bottom step would feed alone until the liquid height in the sprue and in the mold increased together to the level of the middle step. Flow would then occur through the middle step as well as the bottom step. In the same way, when the top step was passed, all three steps should feed.

It is to be expected with conditions of slow steady flow that momentum of the down-stream is unimportant. When flow is rapid, as it is in most pouring operations, it is to be expected, however, that the momentum of the stream will carry it past lateral openings (follow rectilinear path of least resistance) to the bottom of the sprue. The metal will then feed most heavily through the bottom step through the entire casting operation unless sharp angles, baffles, or entrapments are incorporated into the system to dissipate momentum and pressure effects.

To recapitulate, pressure effects (PV) are developed

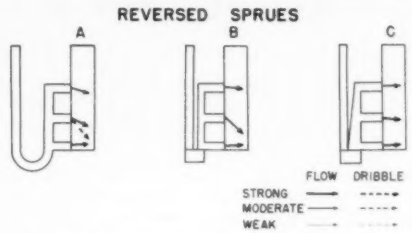


Fig. 10—Diagrams showing functioning of step gating systems when used with reversed sprues.

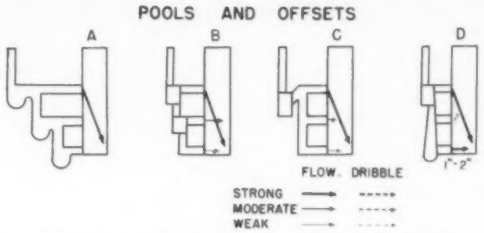


Fig. 11—Effects of pools or offsets on momentum when used with various gating systems.

by the transfer of kinetic energy (Mv^2) to energy of elastic compression. Preferential impingement near or at individual finger inlets results in variations of pressure at these openings, hence to non-uniform feeding from the various fingers. It is possible to counteract such non-uniformity of feeding by varying the individual dimensions of the fingers or the finger angles relative to the runner.

However, this may be done more readily by preventing the development of differential pressures at the finger inlets by the expedient of enlargements in the runner system which result in dissipation of momentum prior to entry into the fingers. This method embodies control of the generation of pressure. Control of pressure dissipation by critical design of finger inlet geometry is a considerably more difficult procedure.

Mold Entry Phase of Pouring—Development of Turbulence: The design of gating systems, as has been pointed out in this and a previous report[1], has a profound influence on the turbulence in a casting. Previous work showed the existence of at least two modes of turbulence in finger gates. These were swirling and rolling turbulence. The investigations recorded here show that a third form, called here rocking turbulence, exists. This type of turbulence results from intermittent feeding through finger gates.

The effects of turbulence, per se, on the properties of castings are not known. Such a study was outside the immediate scope of this investigation. Inasmuch as mold turbulence proved to be an excellent indication of feeding conditions it was used chiefly in this study as a means of determining the uniformity of feeding through the finger. The fact that mold turbulence depends on the gating system indicates that such turbulence can be controlled by the feeding sequence and pattern.

Conclusions

The results of these studies of the flow of molten steel in gating systems in terms of established hydrodynamic concepts requires cautious interpretation, inasmuch as the idealized conditions of lamellar flow in true pressurized systems are seldom met. Actually, the flow conditions are continually changing during the course of pouring. The initial entry of metal into the gating system approaches free fall, but as the system fills, a ferrostatic back pressure is developed and the action approximates that of a pressurized system.

The conditions of first-stage pouring place a predominate importance on momentum and related pressure effects. This stage of flow should therefore be dependent on the specific densities of the liquid.

Second-stage pouring occurs through the development of back pressure; during this period the flow approaches that of a pressurized system. In this stage momentum-pressure effects are reduced and density differences should necessarily be less important.

These studies have shown that uniform or sequence flow may be obtained (1) by elimination of pronounced momentum-pressure effects by use of enlargements, and (2) by control of momentum-pressure effects to aid proper feeding by sharp angles, constrictions or increased flow distance.

Finger gates of special design are required to secure uniform flow. These gates either split the fluid stream into equal parts or absorb the momentum in the runner. Absorption of momentum is most effectively obtained by the use of pools in the runner and with lesser success by bending the runner away from the casting, or by using a tapered runner.

Commonly used step gates cannot be relied upon to produce sequence flow except by modifications using special devices. Studies of single junction and multiple junction steps in step gating show that inclination of the bottom step promotes sequence flow for the two bottom steps. Tapered sprues may also be used, but these are exceedingly critical and no example of full sequence flow was actually obtained by such devices in this investigation.

Turbulence arises from the flow patterns produced by the gating systems. In the investigation to date, three forms have been observed. These are (1) swirling, produced by unequal feeding; (2) rolling, produced by uniform feeding and (3) rocking, produced by intermittent feeding.

Acknowledgments

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TEST BAR COMMITTEE REPORTS

Walter Bonsack
Chairman
Test Bar Committee
A.F.S. Aluminum and Magnesium Division

AN INVESTIGATION to determine the use of tension test bars in the foundry industry was undertaken by the Test Bar Committee of the A.F.S. Aluminum and Magnesium Division. The problem included several basic questions such as the design of the test bar casting including sprues, runner, gating and risering systems used, pouring temperatures, object of using test bars, i.e., what phases of casting production are being controlled.

To obtain a picture of the present status a questionnaire was prepared and circulated among a considerable number of aluminum and magnesium casting producers and consumers.* The number of returns was unexpectedly large, indicating that this subject is of considerable interest to the industry. Since the questionnaire was rather lengthy and required sketches, drawings or other illustrations, and therefore required considerable time and effort to answer, the large return is gratifying. The answers received are the basis of the following report.

The general use of tension test bars is manyfold. They are used in research work in the development of new alloys, that is, composition studies; in the development of melting and refining processes to obtain quality alloys; in heat treatment studies, and others. In the foundry their use is in quality control, i.e., the control of the metal quality, the melting process used, and the heat treatment.

Therefore, test bar molds have been designed to yield reproducible test data which will be indicative of the quality of the alloy when cast under a standardized condition. It is agreed upon that when test bars are poured with production castings and when they accompany such castings through subsequent metallurgical operations they provide a check on the quality of the metal as it goes into the casting, and on the metal-handling practice and heat-treating process *(mechanical properties obtained from separately cast test bars must not be assumed to be the properties actually existent in all parts of the casting)*.

The mechanical properties of the casting itself are dependent upon section thickness, gating, risering, chilling, and all other factors entering into the quality of a mold, in addition to the quality of the metal. It should be realized that these factors may affect the casting to a different degree than the test bar cast from the same metal. Government services require, therefore, only a minimum of 75 per cent tensile strength and a minimum of 25 per cent elongation of the separately cast test bar on test bars cut from critical sections of the casting.

Design of the Test Bar Castings: The dimensions and shape of the test bars of aluminum and magnesium

*This work was done under the chairmanship of the late David Basch.

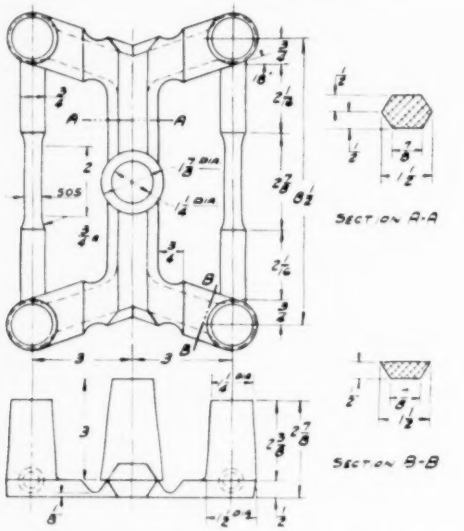
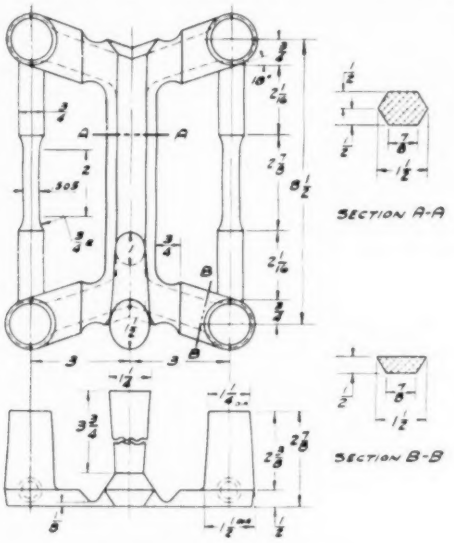


Fig. 1—In this design for aluminum and magnesium test bar castings the metal enters the test bar casting from both ends, uniting in the reduced test bar section.

Fig. 2—The runner and gating system shown in the sketch is recommended in most government specifications for pouring test bar castings of aluminum alloys.



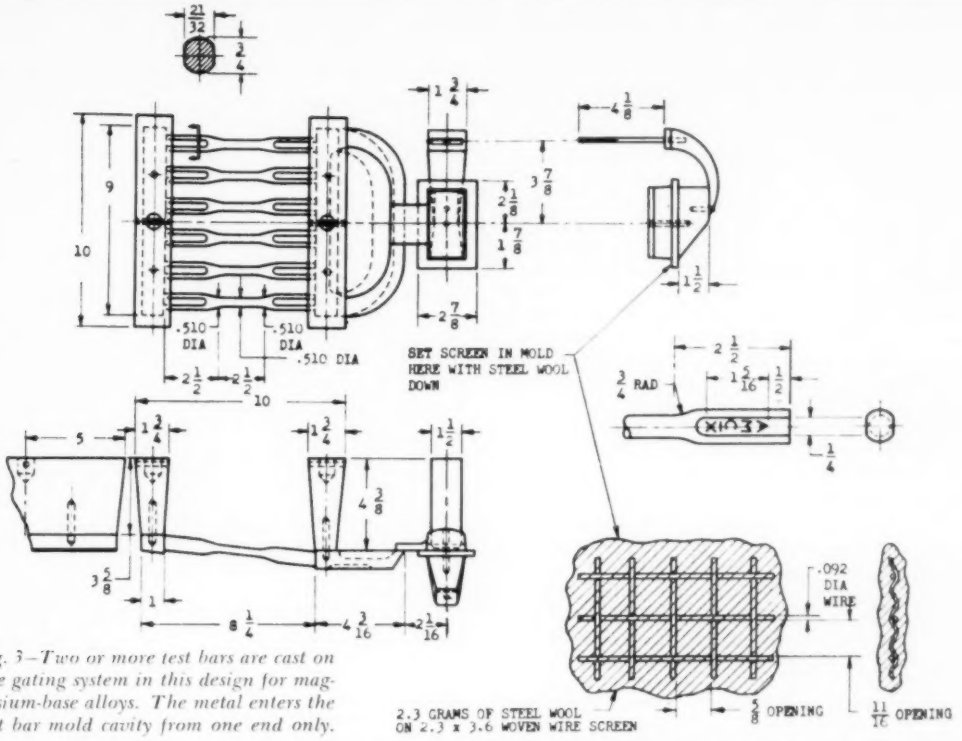


Fig. 3—Two or more test bars are cast on one gating system in this design for magnesium-base alloys. The metal enters the test bar mold cavity from one end only.

casting alloys are standardized by the American Society for Testing Materials Specification E8-46. However, the making of this test bar in the foundry is not standardized and experience has shown that the mold design may vary from foundry to foundry.

In the returned answers 15 different gating and risering designs were submitted. Basically, these designs varied only in two respects—in one group the molten metal enters the test bar section from both ends and unites in the "center" of the reduced test section, and in the other group it enters the bar on one end and flows through the bar into the riser on the other end. Figures 1 and 2 represent the first group; Fig. 3 the second group.

The runner and gating system shown in Fig. 2 represents the casting design recommended in most government specifications for aluminum alloys. The metal is poured into a conical sprue, large end down. The sprue is attached to a central runner which divides the metal into two streams. At each end the stream divides again and through two heavy chokes enters the test bar cavity at each end. The two streams meet somewhere in the reduced section of the test bar, depending on the levelling of the mold.

At this point the metal is the coldest, since it is the farthest away from the sprue. It begins to solidify at the junction of the two streams and freezes directionally towards the risers, which are located at each end and toward the sprue. Theoretically, this method of casting should give the best test bar properties because the metal in the test section is the coldest and usually exhibits the finest grain. Still, there are several points which must be considered in this design:

(a) The sprue is located in the center of the mold. The ladle or pouring vessel must be held high above the mold, causing turbulence and drossing.

(b) The sprue shape is inducive to entrapment of air and gases from the mold.

(c) The dross formed due to pouring heights and shape of sprue is carried along with the metal. Any loose sand particle and the dross formed will finally locate in the section where the two streams of metal meet, i.e., in the test section, causing a bad weld and a defective test bar. This is particularly noticeable in alloys bearing larger amounts of magnesium. In fact, this design is not used for magnesium alloys.

(d) In this design considerable casting stresses are often set up which may cause difficulties during the cutting of the bars due to jamming of the saw. Test bars may be made useless due to bending in sawing.

(e) The amount of metal poured to obtain two test bars is proportionally high.

To avoid turbulence in a few deviations of this mold design, the sprue has been moved toward one end of the center runner, slanted about 45 degrees and the sprue shape turned around, i.e., the small end of the cone down (Fig. 2). This appears to be a much better arrangement, but since the runner is heavily

choked at the ends most of the metal will still enter the test bar from both ends, resulting in defects due to the location of oxidation products at the junction of the two streams. Other variations of moving the sprue from the center toward one end of the center runner also have been reported.

The second type of design, of which a typical casting is shown in Fig. 3, usually has two, four or even more test bars on one gating system. This design is recommended by government agencies for magnesium-base alloys. The metal enters the test bar cavity on one end only. The metal required for the riser on the other end of the test bar is also carried through the test bar section.

The advantage given for the design shown in Fig. 3 is that it is easier to obtain test bars free from dross, dirt and oxides, because these impurities are carried into the risers on the far end. Therefore, this design is particularly favored for magnesium alloys and magnesium-containing aluminum alloys. No casting stresses are set up between the runners and the test bars. Bending during cutting is eliminated.

Large Grain Size Due to Design

In some of these mold designs the risers on the far end are interconnected. No advantage can be found in this feature.

The disadvantage stated for this type of design is said to be caused by the fact that metal has to run through the test bar section to fill the riser on the other end. This may cause increasingly larger grain size towards the sprue end. This larger grain size is said to cause a loss of properties. Whether this loss is greater than the loss of properties due to imperfections caused by dross inclusions and poor welding is open to debate.

It was stated previously that this design is also used for magnesium alloys. Since these alloys are chronically poor-feeding alloys, and since they are very sensitive to grain size changes as far as physical properties are concerned, the foregoing statement about obtaining lower properties in the mold design must be taken with caution. The producers of magnesium alloy castings and the government agencies using magnesium alloys use this design of test bar, shown in AN-M-36 of the Army-Navy Aeronautical Specification (Fig. 3).

The fact that both types of gating and risering are used indicates that there is no distinction in the quality of the test bar. Each design has its advantages, which may be minor to one user but of considerable consequence to another. Both designs give reliable and usable property data. One of the main advantages of the four-bar design over the two-bar design is that with approximately the same amount of metal poured twice as many or even more test bars can be cast. This may be of importance in research work, but also in the foundry where bars from the same pour may be tested under different conditions.

Pouring temperatures of the test bars varied only over a relatively small range, although in some cases test bars are poured at the pouring temperature of the commercial casting. For most aluminum alloys the range was 1200 to 1350F. It should be pointed out in this connection that most property data required in specifications has been established in this pouring-temperature range, and that pouring at higher temperatures will show decreasing properties in the test bar. This must be taken into consideration in evaluating the properties in the control procedure of foundry practice and alloy quality.

Concluding, it should be said that in general only two types of test bar mold designs suggested themselves from this work of the committee. The debatable features on each design limit themselves to very fine distinctions which may be only theoretical in nature.

Committee Personnel

Members of the A.F.S. Test Bar Committee are: Walter Bonsack, chairman, Cleveland; W. T. Bean, Jr., Detroit; J. S. Boudreau, General Electric Co., West Lynn, Mass.; H. P. George, Pitman-Dunn Laboratory, Frankford Arsenal, Philadelphia; Dr. B. M. Loring, Naval Research Laboratory, Washington, D. C.; W. A. Mader, Oberdorfer Foundries, Syracuse, N. Y.; J. C. McGee, Materials Laboratory, Air Materiel Command, Dayton, Ohio; J. W. Meier, Canadian Bureau of Mines, Ottawa, Ont., Canada; R. A. Quadt, Aluminum Div., Hunter-Douglas Corp., Riverside, Calif.; H. J. Rowe, Aluminum Co. of America, Pittsburgh; M. Clifford Rowland, General Electric Co., Schenectady, N. Y.; O. Tichy, Apex Smelting Co., Cleveland; Howard F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.; Sam Tour, Sam Tour & Co., New York; R. E. Ward, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.

Future Meetings and Exhibits

METAL POWDER ASSOCIATION, annual metal powder show, Detroit—April 25-26.

54th Annual Foundry Congress and Exhibit, American Foundrymen's Society, Public Auditorium, Cleveland. May 8-12.

ELECTRIC METAL MAKERS GUILD, annual meeting, Shawnee Hotel, Springfield, Ohio—June 1-3.

INSTITUTE OF BRITISH FOUNDRYMEN, 47th annual conference, Buxton, England—June 6-9.

AMERICAN ELECTROPLATERS' SOCIETY, fourth international electrodeposition conference, Statler Hotel, Boston—June 12-16.

UNIVERSITY OF MICHIGAN SCHOOL OF PUBLIC HEALTH, in-service training course in industrial hygiene and human relations for safety personnel, Ann Arbor, Mich.—June 19-21.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, The Homestead, Hot Springs, Va.—June 22-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting and exhibition, Haddon Hall, Atlantic City, N. J.—June 26-30.

STEEL FOUNDERS' SOCIETY, annual fall meeting, The Homestead, Hot Springs, Va.—Sept. 25-26.

ALL-CANADIAN FOUNDRY CONFERENCE, sponsored by A.F.S. Eastern Canada and Ontario Chapters, Hamilton, Ontario—Sept. 28-29.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, annual meeting, The Greenbrier, White Sulphur Springs, West Virginia—Oct. 12-14.

GRAY IRON FOUNDERS' SOCIETY, annual meeting, Netherland Plaza Hotel, Cincinnati—Oct. 13-14.

TEXAS REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Texas Chapter, Plaza Hotel, San Antonio, Texas—Oct. 19-20.

AMERICAN SOCIETY FOR METALS, national metal exposition and Congress, International Amphitheater, Chicago—Oct. 23-27.

REFRACTORY PRACTICE IN ACID ELECTRIC STEEL MELTING

R. H. Jacoby, Metallurgist
and
M. Petty, Melting Foreman
The Key Company
East St. Louis, Ill.

INTENDED TO SERVE as a guide in establishing or improving refractory practices in the foundry melting acid electric steel for medium-small steel castings, no attempt has been made in the present paper to include ceramic theories. Rather, the purpose is to present a practical outline of established practices in electric furnace shell lining and roof construction, ladle lining, and refractory repair and storage.

Furnace operations in the authors' foundry are concerned with a 1¾-ton direct-arc electric furnace (Fig. 1). A top-charge, swinging-roof unit, the furnace shell is lined with 13-in. silica brick. The bottom is of a molding sand mixture rammed in to a depth of 12 in.

The molding sand mixture is rammed to a predetermined depth over the bottom and is shaped from the center out, sloping up to the bottom of the charging door and spout opening. A ledge is created at this height completely around the furnace, at right angles to the side wall, extending in 13 in. from the shell. This is done in order to establish a sound foundation for the silica brick side walls.

Preprint No. 50-48. This paper will be presented at a Refractories Session of the 54th Annual Meeting, American Foundrymen's Society, at Cleveland, May 8-12, 1950.

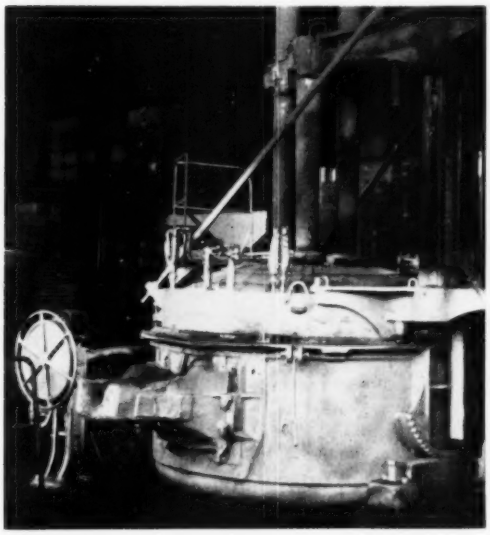


Fig. 1—The melting unit is a 1¾-ton direct-arc electric furnace of the top-charge, swinging-roof type.

Side-wall construction is started at the door and spout openings. These particular brick are usually wedge-shaped in order to incline toward the center of the furnace. In continuing in a radial fashion with the side-wall brick, the bricks are tilted downward about ½ to ¾ in. from the level. This is the allowance made for the inner brick face expansion during the operation of the furnace, which will tend to level the bricks in relation to the furnace.

The bricks in the next course are staggered, as is standard practice in any bricklaying operation. The door jambs are started on each side of the charging door, special shapes being used for this purpose. Subsequent courses of brick are laid following the same procedure. The tapping hole size is governed by personal preference. In this particular case, a rectangular opening 8 in. wide by 12 in. high is allowed (Fig. 2).

Fig. 3—The charging door must be carefully constructed. Skew bricks are placed on top of the door jambs, and wedge-shaped bricks on the arch.

Fig. 2—The method of constructing the tap hole is shown in this view. In this furnace the tap hole dimensions are 8 in. width and 12 in. height.

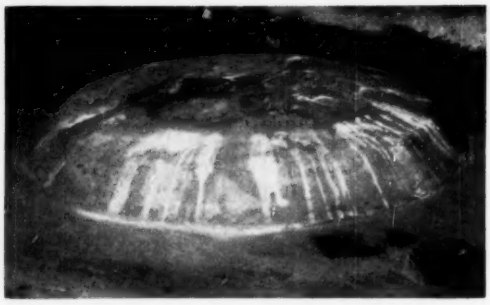
At the top of the door jamb the arch must be set. The setting of the arch is important and should be carefully done. General procedure involves the placing of a wooden arch form across the edges of the two door jambs. A skew brick is laid on top of each jamb, and the wedge-shaped arch brick are laid in a radial manner toward the top of the arch. At the top, the selection of brick size is made to give a secure fit of all the shapes in order to insure good unit strength of the arch (Fig. 3).

The curved top of the arch is levelled off with addition of a mulled gannister mix of 30 per cent fire gan (⅜ in. and smaller rock gannister), 30 per cent fire clay, and 30 per cent coarse silica sand. This provides a flat, level base for the roof ring over the arch and eliminates the possibility of any burning of refractory at this point during furnace operation. Laying of the courses of side-wall brick is continued to a point parallel with the top of the furnace shell side walls. The last courses are worked over to the conjunction

Fig. 5—Cardboard expansion strips are inserted between every fourth brick on each course of the roof brick.

Fig. 6—Special shapes are used to construct openings around electrodes.

Fig. 4—A wooden form is used for laying up the brick in the roof ring.



with the arch in the charging door. The whole assembly is finshed off with a layer of gannister mix.

The furnace bottom is then carefully worked to a bowl shaped curvature, the depth of which is controlled by the use of a wooden gage running between the charging door sill and the spout. A measurement of 14 in. is held from the center of this gage down to the rammed furnace bottom. The breast, the area in front of the spout, is shaped to insure the even and complete emptying of the furnace when tilted for tapping. Finally, the spout lip extending off the front of the furnace is rammed in with a gannister mix, contoured to a trough shape and washed with a slurry.

Upon completion of the "ram-in" on a new furnace bottom a wash of glutrin water is applied to the surface, followed by a 30-min drying period by means of arcing against crossed scrap electrodes on the bottom.

Extra roofs for the top-charge, swinging-roof furnace are made up and kept ready for immediate installation in the event of failure of the roof in operation. A wooden form is used for laying up the brick in the roof ring (Fig. 4). The roof ring consists of a channel shaped concentric section of steel used as a retainer and holding mechanism for the roof.

Before proceeding to lay the brick in the roof ring the concentricity of the ring should be checked and, if water cooled, tested for leaks. This is necessary because a ring often becomes warped in service; when the warpage becomes too severe the ring must be straightened, and leaks often result.

The bricks in the first course of the roof ring are known as skew bricks, and they are specially shaped to conform to the particular design of water chamber in the roof ring. In laying the roof brick cardboard expansion strips are inserted between every fourth brick on each course (Fig. 5).

Roof bricks are made in standard sizes and special shapes. In this foundry special shapes are used—fewer bricks are required, less skilled labor can be used, and the roof can be laid in a shorter time (Fig. 6). These factors offset the higher initial cost of the brick.

Roof brick shapes are carefully set up to the area of the electrode openings, where three plugs are inserted into the wooden form. These plugs represent the allowance for electrode openings in the roof. As the shapes forming the electrode openings are special, it is a simple matter to insert them in their proper places across the center section of the roof. The key brick is round and in the immediate center of the whole assembly. It should only be necessary at this point of the assembly to slide this brick into place.

Start New Roof on New Lining

Storage of a complete roof should be effected at least 3 to 4 ft off the ground. In the assembly of a roof on the furnace an attempt is made to start a new roof on a new lining in order to avoid the overhang of roof brick that is involved when a new roof is put on an old lining. Excessive spalling can generally be expected when it becomes necessary to install a new roof on an old lining.

Operating methods will affect the life of the furnace refractory. After each heat is tapped an examination is made of the furnace bottom. A silica sand and glutrin mixture of the consistency of core sand is placed where any holes or erosion appear. Particular scrutiny should be given to areas around the slag line on the furnace and the areas in front of the charging door and the tapping hole. The charge is placed care-

fully in the furnace with the heavier material on the bottom. After tapping the furnace the tapping spout trough outside the furnace is chipped off and repaired, using a molding sand mix.

During the life of a furnace lining it generally becomes necessary to replace the charging door arch and door jambs. These repairs can be made on the cold furnace before starting in the morning. The old bricks are chipped out and the new bricks set in place. This work, along with the replacement of two or three top courses of side-wall brick, is common practice during the life cycle of a furnace lining.

During a shut-down period the condition of the side walls, bottom door and spout areas must be closely observed. This is done to avoid operating the furnace to a point where metal would burn through the refractory and shell, creating a maintenance problem as well as an expensive shut-down period. The furnace bottom is not replaced during a furnace reline. Instead, any metal is chipped out from around the furnace bottom. It should not be necessary to ram more sand on the bottom during a reline. Good furnace practice between heats calls for the proper sanding-in of the furnace in order to retain a reasonably smooth, contoured, consistently level furnace bottom. During operations the furnace roof is kept well cleaned of dust and dirt.

During a shut-down period a charge is placed in the furnace and the roof swung back onto the furnace. This is to insure the minimum of thermal shock to the roof during cooling. Generally, the roof life is shortest in the center section. This is probably due to a combination of erosion from the arc and heat reflection from the slag-metal surface. It is possible in good practice to replace the center brick in order to lengthen the time of service of the roof.

Lining the Ladle

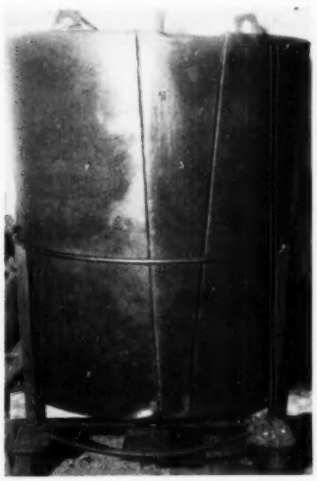
The bottom-pour ladle is used exclusively in the authors' foundry. This ladle is lined with a rammed-in mulled gannister mixture consisting of 30 per cent rock gannister, 30 per cent fire clay, and 30 per cent coarse silica sand. The mixture is rammed with air hammers around a metal-covered wooden form which is then drawn from the ladle, leaving a well contoured lining (Fig. 7).

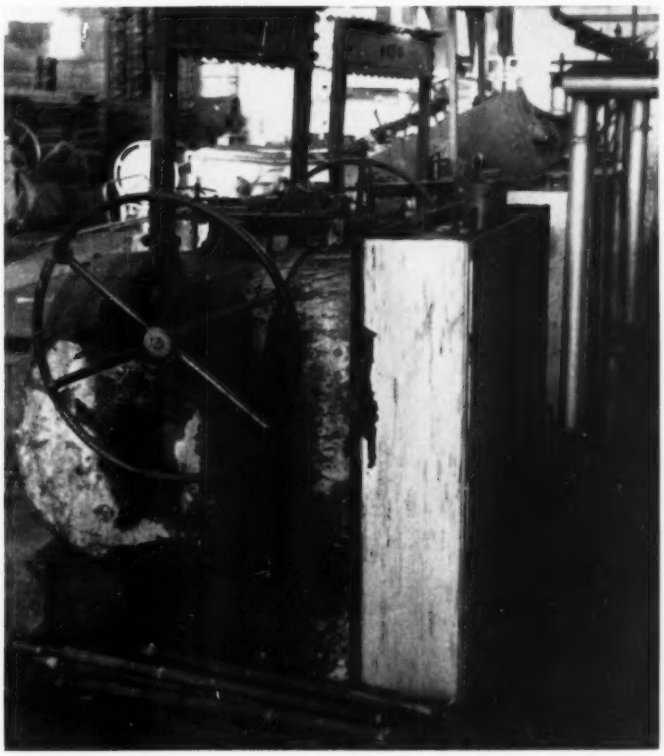
It is important that the gannister mixture be added around the form in small quantities and rammed down hard before adding more. This is to insure the maximum density of the rammed-up material.

The bottom is rammed in next, tying in carefully with the side-wall material. A large clear spot having been left in the nozzle area, the nozzle is inserted and the gannister rammed hard around the nozzle and the bottom shaped and smoothed over into the nozzle well. The completed ladle shell is then brushed over with a clay slurry, set aside and allowed to air dry for at least 48 hr. After this period the ladle is dried on low fire, about 1000 F, for 8 hr, then turned up to a cherry red, about 1600 F, for at least 15 hr before use (Fig. 8).

Fig. 8—Ladles are air-dried for a period of 48 hr—on a low fire at 1000 F for 8 hr—and at a cherry red (1600 F) for 15 hr before use.

Fig. 7—The bottom-pour ladles are lined with a gannister mixture. Air hammers are used for ramming up the gannister mixture around the metal-covered wooden form.





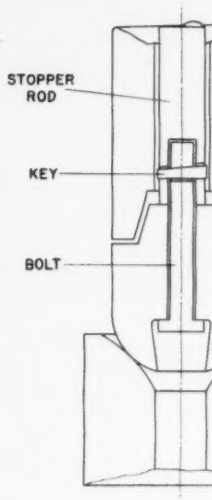


Fig. 9 — Sketch showing details of the ladle stopper rod assembly.

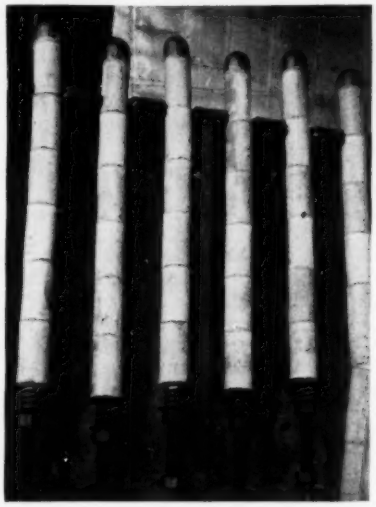


Fig. 10 — Stopper rod assemblies, complete with fire-clay sleeves, are dried at 200 F temperature before use.

The stopper rod assembly consists of fire-clay sleeves the length of the rod, the black head, stopper pin and wedge (Fig. 9). In assembly the stopper pin is assembled in the black head. The black head assembly is inserted in the stopper rod and the wedge driven in place, and subsequently covered by the fire-clay sleeves, all joints being cemented in and to the rod with high-temperature cement (Fig. 10). The opening in the black head is filled with a special cement supplied by the black head manufacturers. The entire assembly is allowed to dry at a low temperature—about 200 F.

In setting up the ladle for a heat the ladle is brought off the fire and turned upright. The stopper rod assembly is dropped in position from the crane and bolted on. A coil spring located between the top nut and the last sleeve allows for expansion of the clay sleeves (Fig. 11). The assembly should be adjusted to produce a wiping motion across the face of the nozzle in closing. This clears the nozzle and insures a better seat in the ladle bottom.

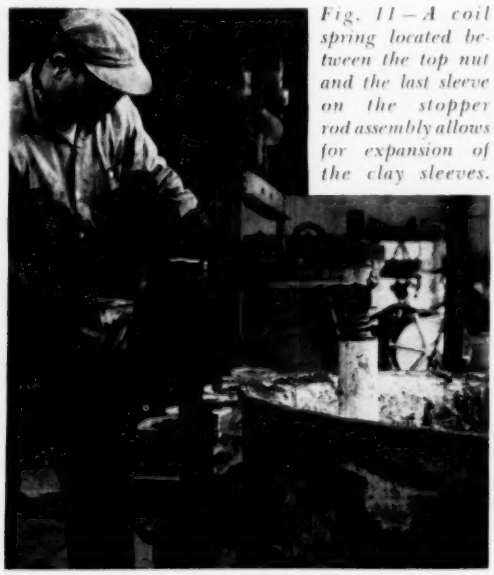


Fig. 11 — A coil spring located between the top nut and the last sleeve on the stopper rod assembly allows for expansion of the clay sleeves.

After installation the stopper is closed. A handful of fine silica sand is thrown around the stopper and nozzle junction. A shovel placed under the nozzle and beneath the ladle bottom is subsequently examined for any leakage of the fine sand thrown in the ladle. It is important that the sand be blown out of the ladle before tapping.

After each heat the nozzle is knocked out of the ladle. The stopper rod assembly having been pulled, the sleeves are broken loose and the rod and black head pin returned for reassembly. After the ladle cools sufficiently the slag and metal, if any, around the top of the ladle are chipped down. The bottom is cleaned and the area where the nozzle is to be reinserted chipped out clean. A new nozzle is positioned and a sand-gannister mixture used for setting in place. Cleaned of refuse, the ladle is dried at a red heat and returned for another use.

Refractory Storage

Due to the relatively high cost of furnace refractory, storage facilities are such as to preclude the possibility of abuse in handling, resulting in excessive breakage. A perpetual inventory is carried for all melting department refractories. The furnace shell, roof, and ladle lining condition, as well as the number of heats, are recorded on each heat log.

Since any discussion of refractory life and service must necessarily concern itself with the service and operating conditions to which the refractories are subjected, comparisons become relative even if good

practice prevails. Furnace linings and roofs in the shops melting for small, intricate shank castings would have problems not encountered in the melting of metal for heavy carbon-steel castings in a similar furnace, where tapping temperatures would be lower. Likewise, continuous melting of high-alloy steel in a furnace shell would create an entirely different picture as compared with the production of straight, medium-carbon steel in the same shell.

The melting unit in the authors' foundry operates on a 16-hr per day cycle. Over 60 per cent of the tonnage is alloy steel of the chrome-moly, chrome-nickel grade, including the stainless classifications. Tapping temperatures are not high, as no shank work is involved. The roof life is about 170 heats per roof. Furnace lining life is about 200 heats. The furnace bottom has been replaced only once in the past 8 years. Average ladle life is 65 to 70 heats per ladle. The ladles handle an average heat of 4 to 4½ tons.

A.F.S. Northern California Chapter Publishes 1950 Roster and Directory

DEDICATED TO THE EFFORTS of chapter and national committeemen of A.F.S. to advance the foundry industry is Northern California Chapter's newly-published 1949-50 *Industry Directory and Roster of Members of the A.F.S. Northern California Chapter.*

The 36-page booklet contains a complete roster of chapter members and their companies, a list of area foundry supply organizations, a roster of chapter officers and directors and a listing of committee personnel and past chapter chairmen.

Also included in the booklet are lists of Northern California foundries classified according to ferrous, non-ferrous, etc., casting products, member pattern shops, Northern California Chapter Company and Sustaining members and by-laws of the Chapter.

A.F.S McFadden Gold Medalist Dies

FIRST DIRECTOR of Battelle Memorial Institute, one-time associate of Thomas A. Edison and A.F.S. McFadden Gold Medalist, Dr. Horace W. Gillett, 66, died of a heart attack March 3 in Nicholasville, Ky., while returning from a hunting trip in the South.

Sometimes referred to as the "Dean of American Metallurgy," Dr. Gillett was responsible for the technical organization of Battelle Memorial Institute, and served as its first director from 1929 to 1934. Appointed the first editorial director of *Metals and Alloys* magazine, Dr. Gillett was the inventor of many metallurgical processes and author of several books on scientific subjects. At the time of his death he was serving in the capacity of technical consultant to Battelle, having retired as chief technical advisor of the Institute last year.

Awarded the A.F.S. McFadden Gold Medal in 1932 for "outstanding contributions to the metal casting industry," Dr. Gillett delivered the Annual Foundation Lecture (predecessor of the Charles Edgar Hoyt Annual Lecture) of the American Foundrymen's Society at the Society's 1944 Convention in Buffalo. He was also honored by the Institute of British Foundrymen as its fifth Annual Edward Williams Lecturer.

Missouri Mines Student Chapter Members Visit Key Co. Foundry

Members of the Missouri Mines Chapter of A.F.S. viewed steel foundry operations at the Key Co., East St. Louis, Ill., March 9, and attended the St. Louis District Chapter meeting that evening.

Dr. D. S. Eppelsheimer (left) of the Missouri Mines metallurgy department, faculty adviser to the student chapter, and Key Co. General Manager Fred B. Riggan accompanied students.

PRECISION CASTING ALUMINUM IN MOIST INVESTMENT MOLDS

H. Rosenthal
and
S. Lipson
Metallurgists

Dunn Laboratory
Frankfort Arsenal
Philadelphia

A TECHNIQUE HAS BEEN DEVELOPED for retaining varying amounts of moisture in plaster-bonded investment molds in order to improve the properties of aluminum alloys cast by the precision investment process. The new mold consists of a precoat applied to the wax patterns, over which a backing investment is poured. The backing investment contains a large number of air bubbles to increase its permeability so that the steam generated by the hot metal in the moist mold can escape.

Test bars cast into these molds showed an increase of 15 per cent in tensile strength. A comparison of this technique with the standard investment process indicates a potential saving in investment material, as well as in labor requirements for investing large numbers of molds.

The importance of cooling rate on the mechanical properties of cast aluminum is well known. Standard investment molds are completely dried and of very low heat conductivity. It is to be expected that the mechanical properties of aluminum alloys cast into such molds are low relative to castings made in metal or even green sand molds.

The problem of improving properties of aluminum investment castings resolves itself into one of finding some way to increase the chilling power of the investment. Three techniques were considered for improving the heat conductivity of the investment: (1) adding a conductive material to the standard investment; (2) refrigerating the mold prior to pouring the metal; and (3) retaining moisture in the investment as a cooling medium.

Addition of a conductive material was not considered promising because only a limited amount of such a material can be added without destroying the nature of the investment. In this amount the grains of conductive material would be surrounded by the refractory so that no continuous network of the conductive material could be established. Without such a continuous network the improvement in chilling power would be negligible.

Refrigeration of the mold was considered feasible but did not seem to promise any great improvement so far as properties were concerned. It was felt that although the lower mold temperature would cool the metal faster, fundamentally the rate of heat transfer through the refractory would still be low.

Moisture used as a cooling medium, as suggested by

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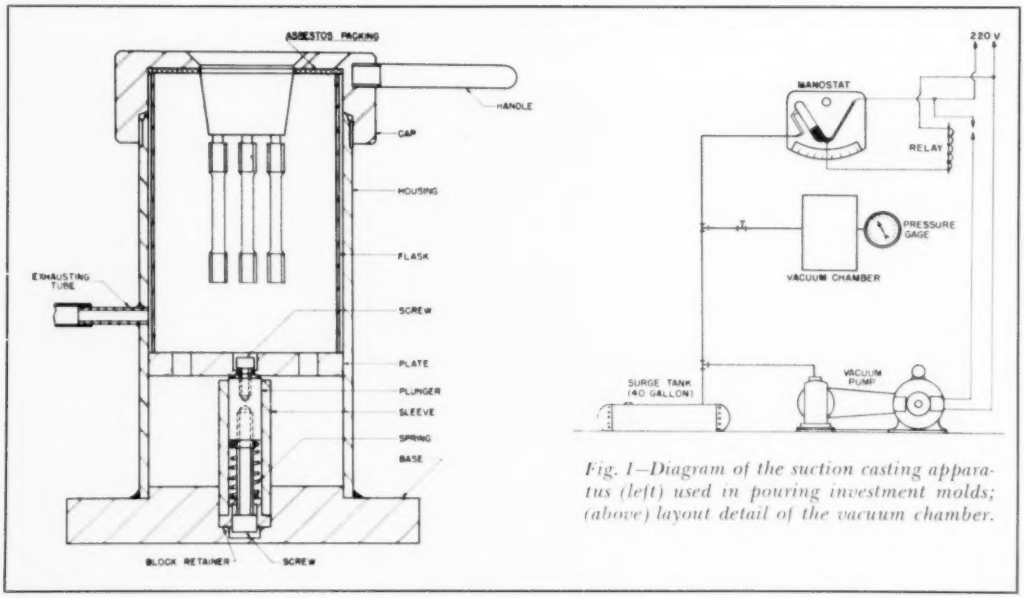


Fig. 1—Diagram of the suction casting apparatus (left) used in pouring investment molds; (above) layout detail of the vacuum chamber.

Fig. 3—This precoated wax pattern is mounted on a rubber sprue base, and has been reinforced with a screen in the center.

Fig. 4—A plaster mold sectioned to show the permeable investment material surrounding the precoated wax pattern.

the third method, was considered the most promising of the three. It provided the greatest ability to chill the metal since the vaporization of water is a potent means of abstracting heat. In addition, the mechanical problem of adding water to the investment, or retaining the proper amount, appeared relatively simple.

Eliminating Wax

Before the retention of moisture could be considered it was necessary to have a method of eliminating the wax at a temperature compatible with the retention of the required amount of moisture in the investment. The standard technique[1] is to melt out as much wax as possible in a low-temperature oven and then burn out the remainder at high temperature.

When the wax is melted out in an ordinary oven an accompanying loss of moisture from the investment occurs. The melting wax thus has an opportunity to seep into the capillaries formed by the escape of the moisture. Once the wax has been absorbed into the cellular structure of the partially dried investment, it cannot be eliminated in a reasonable time at temperatures under 800F (425C).

Previous work had shown that substantially complete wax removal could be made in a steam autoclave. In this saturated steam atmosphere an equilibrium is set up between the moisture in the atmosphere and the moisture in the mold, so that in spite of the elevated temperature there is no tendency for mold dehydration. The molten wax can thus be drained with no appreciable residue requiring elimination at high temperature. This autoclave treatment was used to remove the wax from all of the molds tested.

As a logical first experiment, the standard 70 per cent silica—30 per cent plaster investment was used. This investment is designed for use in the completely dried condition. The mechanically held water can be eliminated by baking the mold at a temperature of 212F (100C), after which the chemically held water in the gypsum is driven off by heating at a higher temperature. The usual method for elimination of the wax automatically requires a much higher temperature than is needed for the dehydration of the gypsum. However, having discovered the possibility of eliminating the wax by the autoclave treatment, it was feasible to retain as much moisture in the mold as desired.

Permeability of the investment material is a function of the voids present. These voids are formed when the mechanically held water is driven off. Therefore, it was decided to use a mold which had been heated sufficiently to eliminate the mechanically held water but which still retained the chemically bound water.

The prepared mold was placed in a suction casting device (Fig. 1) and an aluminum alloy was poured into it. A violent bubbling action was noted as the steam forced its way through the molten metal. On breaking out the casting it was found that the cavity had only been partially filled in a manner which indicated that the pressure developed by the steam had restricted the flow of the incoming metal.

From this experiment it was concluded that the

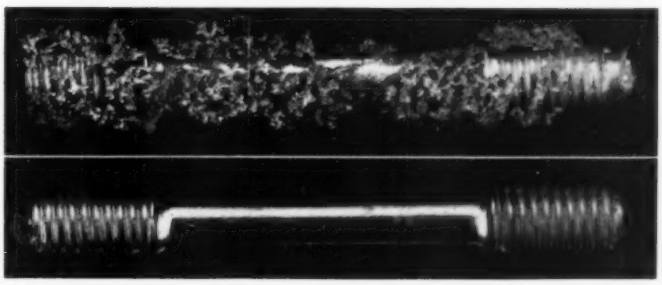


Fig. 2—The test specimen (top) was poured in a moist plaster mold made without precoating the wax pattern, and had considerable metal penetration of the thin surface layer of plaster. A second test bar (bottom) was poured in a mold made from a precoated pattern.

TABLE 1 - TENSILE TEST DATA OBTAINED WITH SPECIMENS CAST INTO INCOMPLETELY DEHYDRATED MOLDS (ALLOY 85)

(Mold Temp: Room Temp Pouring Temp: 1200 F)

Heat No.	Water Loss %	Property	Specimen No. 1	2	3	4	5	6	M	σ
1	40.9	T.S.	25.5	24.9	26.5	25.0	26.2	24.6	25.45	0.69
		El.	3.2	3.0	3.4	2.4	3.0	3.3	3.0	-
4	40.3	T.S.	27.6	26.3	27.2	26.8	27.2	26.7	26.97	0.40
		El.	3.4	*	*	*	3.2	*	3.3	-
5	37.1	T.S.	26.7	26.6	26.8	27.1	28.0	26.7	26.98	0.50
		El.	3.8	*	3.7	3.7	*	3.6	3.7	-
6	32.3	T.S.	26.4	26.3	25.5	26.3	25.9	-	26.11	0.33
		El.	3.4	3.6	*	3.6	*	-	3.5	-
7	29.3	T.S.	26.7	26.9	26.1	26.8	26.5	-	26.6	0.28
		El.	*	3.4	3.4	*	*	-	3.4	-
8	34.4	T.S.	27.5	27.2	27.0	25.7	-	-	26.85	0.76
		El.	3.7	3.8	*	2.9	-	-	3.5	-
9	39.4	T.S.	24.8	25.7	25.9	25.2	25.5	-	25.42	0.33
		El.	*	3.8	3.1	2.8	3.1	-	3.2	-
10	40.7	T.S.	24.4	24.5	25.9	25.5	24.9	-	25.04	0.58
		El.	2.9	2.7	*	3.2	*	-	3.0	-
11	38.9	T.S.	27.8	27.9	28.9	27.5	27.8	-	27.98	0.47
		El.	4.0	*	4.0	*	3.8	-	3.9	-
12	38.7	T.S.	27.7	27.5	27.0	26.9	26.8	26.9	27.13	0.40
		El	3.0	3.0	3.1	*	2.8	2.6	2.9	

* Broke outside gage length T.S. = Ultimate Tensile Strength, psi/1000

M = Arithmetic Mean

σ = Standard Deviation, (+) psi/1000 El. = Elongation, % in 1 in.

permeability of the standard investment was much too low. A more suitable material was found to be the permeable metal casting plaster described by Miericke and Johnson[2]. This material was designed for use in plaster mold casting, not for investment casting. When mixed with water and stirred by a beating action a considerable amount of air is drawn into the mixture in the form of bubbles, which are stabilized by a foaming agent.

It is claimed, however, that when the prepared mix is poured against the patterns used in plaster mold casting a smooth layer of the material is deposited against the patterns. Thus the bubbles beneath the surface do not interfere with production of a good surface finish on the final casting.

A batch of the permeable plaster was prepared and poured against the wax patterns in the same manner as is customary with the standard investment material. The mold was baked until the mechanically held water had been vaporized and only the chemically held water of the gypsum retained. An aluminum alloy was poured into the mold, using the suction casting fixture as before. No bubbling was noted, but the casting had the appearance shown in Fig. 2 (top). It is apparent that the metal had penetrated the thin surface layer and filled the spherical voids below the surface. These voids are the result of the bubbles incorporated into the mix by the foaming agent.

Refractory Pattern Coating Needed

In order to overcome the surface condition it was necessary to devise some procedure to precoat the wax patterns with a suitable refractory prior to the application of the permeable plaster. The most convenient material for this purpose was the standard investment. The precoating material was made up and the wax pattern assembly was dipped into it, but the freshly prepared mix was found unsuitable because it was too watery in consistency and ran off the patterns, leaving bare spots. This was corrected by allowing the mix to stand until a thicker consistency was reached by the setting process of the plaster. It was then found that if immediately applied over the precoat the permeable plaster tended to wash away parts of the precoat, and it was necessary to first dry the precoat. On casting into molds, using the dried precoat technique, it was found that the precoat tended to spall, causing a characteristic type of failure on the surface of the casting. The spalling action indicated that the precoat was not being bonded to the back-up material.

Procedure Developed

This defect was corrected by sprinkling 20-30 mesh Ottawa sand over the surface of the still tacky precoat. The sand thus served as a keying agent in binding the precoat material to the permeable plaster back-up material.

The final procedure consisted of the following steps: (1) dip pattern assembly in ethyl alcohol to remove grease and dirt; (2) coat patterns with the precoating mixture of 100 grams investment per 48 cc water, waiting a few minutes until slightly thickened; (3) sprinkle 20-30 mesh Ottawa sand over the tacky precoat; (4) pour the permeable investment around the precoated patterns (100 grams per 75 cc water, mixing at 200-400 rpm in mechanical mixer for 2 min).

Figure 2 (bottom) shows a tensile specimen obtained from a mold prepared according to the foregoing procedure. Figure 3 illustrates a specimen mounted on a rubber sprue base. The specimen has been precoated, sprinkled with sand, and reinforced by a screen.

In Fig. 4 a sectioned mold shows the wax pattern as the dark portion surrounded by the white precoat. The precoat is surrounded in turn by the permeable investment, the porous nature of which is indicated by the numerous bubbles throughout the mass.

Properties of Tensile Specimens Cast in Wet Molds

After mastering the technique of casting into a wet mold, it was possible to determine the mechanical properties of aluminum when cast under these conditions. The amount of moisture retained in the mold could be controlled by the baking time and temperature. In order to determine the optimum moisture content for the best mechanical properties a number of tensile specimen molds were cast. The baking cycles for these molds were varied so that various amounts of moisture were retained. Tensile specimens from these molds were tested to determine ultimate strength and elongation. Standard 0.252 in. diameter, 1 in. gage length specimens gated from one end were used.

The alloy used in these tests was a 5 per cent silicon —4 per cent copper aluminum alloy. It was melted in a clay-graphite crucible which was heated in a 30-kw high-frequency converter. The casting temperature was adjusted to 1200F (650)C as measured by a chromel-alumel thermocouple. The suction casting fixture was used with an absolute pressure in the surge tank of 10 psi, which is equivalent to a theoretical pressure of 5 psi on the exposed head of metal.

Table 1 lists the results obtained with varying

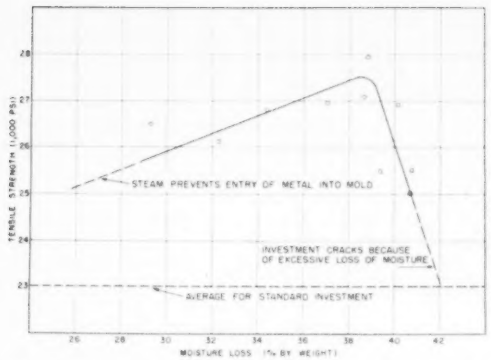


Fig. 5—Tensile data plotted to show the effect of moisture in the mold on the tensile strength of aluminum alloy No. 85. The molds were at room temperature.

amounts of residual moisture. Data shown in the table include the per cent weight loss of the mold due to the elimination of water in the baking cycle, the ultimate tensile strength and per cent elongation of the tension test specimens. Specimens cast into standard dry molds at the same pouring temperature used in the present work show tensile strength 15 per cent lower than the maximum shown in Table I.

Mold Moisture Affects Properties

The tensile data are shown in graphic form in Fig. 5. It may be noted that the maximum properties are obtained when the moisture content of the mold is reduced to correspond with a weight loss of 38-39 per cent. This weight loss was obtained by heating the molds for 12 hr at 300F (150C). The exact time and temperature of the drying cycle are not important since they will vary with the characteristics of the furnace used. Circulation of the furnace atmosphere is probably the most important single factor in determining the drying efficiency of a given furnace.

In spite of the scatter of the data, the general shape of the curve is readily apparent. On the left there is a region of such high moisture content that it is impossible to cast the metal into the mold without having the steam interfere with the entry of the metal. With less moisture, the casting is made successfully, but the properties are not as high as those recorded with somewhat drier conditions.

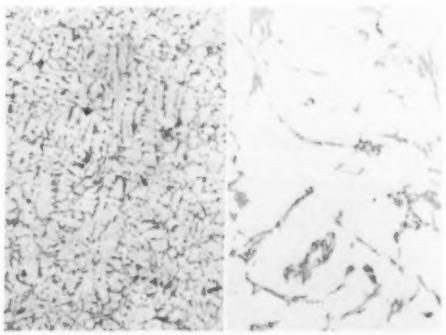
An optimum condition of moisture content is reached at which the mechanical properties are at a maximum. As drier and drier molds are tested the properties decline. There is a practical limit to which the molds may be dried, since the investment tends to crack when too much moisture is lost. For this reason it was not feasible to extend the curve sufficiently to the right to show its merger with the level characteristic of the standard dried molds.

The microstructures of the tensile specimens were examined and representative areas are shown in Fig. 6 at 50 and 250 magnification. The microstructure of the specimen cast into the moist mold as compared with that of the specimen cast into a standard investment mold is considerably finer, and this is due to the greater chilling power of the moist investment.

Although the technique presented in this report cannot be considered perfected as yet, it is possible to compare it in general terms with the standard investment method. The use of a precoat by the proposed method introduces a complication, but this is offset by a simplification of other parts of the procedure.

In the standard method it is necessary to use two vacuum treatments. The first treatment is used on the investment mix and the second on the flask containing the freshly poured mix. The volume of investment mixed in a batch is limited by the capacity of the vacuuming system and the setting rate of the investment. Using a precoat technique, only the precoat need be vacuumed, thus eliminating the second operation.

With a suitable precoat it should be possible to coat a large number of patterns at one time. Since the limitation of a vacuuming operation cannot interfere, it is possible to make up a large batch of the backing investment for filling many flasks at one time. The net effect seems to be an increased efficiency and time saving in spite of the added predip operation.



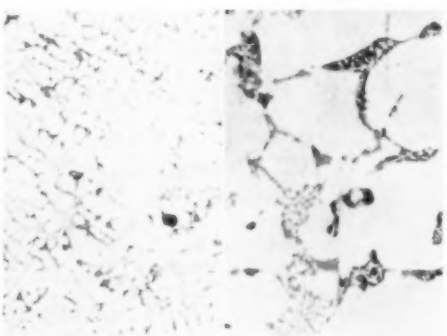


Fig. 6—Microstructures of aluminum alloy tensile test specimens cast in a moist mold and standard dried mold. Etchant, Fe $(NO_3)_3$. X50 and X250.

The thermal treatment of the molds, usually referred to as the "burnout," is an inexpensive operation compared with the treatment required with the standard investment. It may be done overnight at a low temperature, such as 300F (150C), or may be accomplished in a few hours at higher temperatures. An incidental saving during the casting operation is found in the fact that the moist investment causes the metal to solidify more rapidly, thus increasing the output of a given casting fixture.

In matter of cost, the new technique enjoys a marked advantage over the standard investment. Neglecting the cost of precoat, which is slight in any event, the cost of the backing investment is only a fraction of the cost of the standard investment. Taking into consideration also the fact that backing investment has half the density of the standard material, there is an even greater potential saving in investment material.

In precision casting the cost of the investment is determined to a large extent by the size of the casting. Small castings use little in the way of investment materials, and the major part of the cost is in the labor expended in making the part.

With large castings, the cost of the investment becomes an important factor in the price of the casting, since the investment consumed in making the casting represents a large proportion of the total cost of the part. Thus, any means by which investment costs can be reduced should stimulate the use of the method for large castings which are not economically feasible at present because of the high investment cost.

Conclusions

1. Retained moisture in investment molds causes a significant improvement in the mechanical properties of aluminum-copper-silicon alloys.
2. Molds prepared by the technique described in this report are less expensive than standard type molds.
3. Burnout of molds is simpler and less costly than with the standard investment material.

Acknowledgment

The authors are indebted to the Department of the Army for permission to publish this report. The opinions expressed in the paper are those of the authors and are not necessarily endorsed by the Department of the Army.

References

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Present A.F.S. Memberships To Apprentice Contest Winners

Local apprentice contest winners, pictured with F. W. Burgdorfer (front center), Missouri Pattern Works, chapter apprentice committee chairman and member of the A.F.S. Apprentice Contest Committee, received cash prizes and memberships in A.F.S. at the March 9 meeting of the St. Louis District Chapter. In the front row, left, to right, are: James L. Bailey, KRS Bronze Foundry; Allen Schroder, National Bearing Metals; Paul DeSantis and Carl VanAlstine, both KRS; Richard Bowman, American Car & Foundry Co.; and William McGrew, Semi-Steel Casting Co. Back row, starting left, are William Burkholder, Central Pattern Co.; Carson Seawel, Progressive Pattern Co.; Ernest Kramer, Quality Pattern Co.; Russell Elze, Central Pattern; Warren Hey, Quality Pattern; John Asholt, American Steel Foundries, Granite City, Ill.; Merle Griemer, Remmers Pattern Co.; Eugene Kaetzel, Central Pattern Co.; and William Zimmer, Arnette Pattern Co. Best patterns and castings made by the group will be entered in the Annual A.F.S. Apprentice Contest and will be displayed at the Society's 1959 Convention and Foundry Show in Cleveland May 8-12 when first-place winners in the five divisions of the National Contest will be awarded prizes and certificates at the Annual Meeting by A.F.S. President E. W. Horlebein.

WAGE INCENTIVE ADMINISTRATION

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FOR MANY YEARS management and labor have been jointly interested in improving the American standard of living. However, they have learned by recent experience that higher wages, if followed by higher prices, is not the solution of their problem. Under this condition purchasing power remains unchanged and the standard of living is not improved. Consequently, they are now seeking ways to widen the difference between the level of wages and the level of prices.

Management is seeking ways to reduce costs and selling prices, earn a reasonable profit, and at the same time at least maintain the present wage level. Labor, on the other hand, is seeking higher wages and, in some instances, has proposed that the cost of these increases be paid out of corporate profits, rather than passed on to the consumer.

This proposal by labor might be a solution of the problem if the profits of each company in industry were sufficient to absorb the cost of further wage increases and still leave adequate funds for working capital, reserves, and the payment of dividends. Unfortunately, very few companies in the foundry industry are in such a favorable position. On the contrary, due to declining volume and prices, the situation is quite the opposite. Therefore, many foundrymen must increase their profit margin if their businesses are to survive and prosper.

If management and labor are to gain their objectives it must be through increased production per man-hour and lower unit costs. This is the only sound basis for higher wages and lower selling prices. In their endeavor to achieve lower costs and higher wages, management and labor should cooperate and make a sincere effort to use time study and its sequel, the wage incentive, to better advantage than they have in the past.

The basic principle involved in a wage incentive plan is payment of wages on the basis of output rather than by the hour. The purpose, of course, is to induce the worker to produce more and thus earn more than he would otherwise and, at the same time, lower the cost per unit of production.

Management's Responsibility

Wage incentives have been used in industry for nearly 70 years. However, they have not always accomplished their purpose. In some plants the results have been entirely satisfactory. In other plants the plan has been a complete failure. Perhaps then if we learn what contributes to success, and what causes failure, we will have made some progress toward solving management's and labor's problem.

The success of a wage incentive plan, like that of any other major project, depends largely on top management. In the development and administration of the plan authority and responsibility must necessarily be delegated to various members of the organization. Nevertheless, it is still management's responsibility to see that objectives are achieved.

Management must then be watchful to see that details essential to success are not overlooked or neglected. If weakness or negligence is apparent at any time, prompt action must be taken to correct the condition. Unless this is done the condition becomes malignant and failure is inevitable.

Cooperation of Supervision and Labor

To accomplish its purpose a wage incentive plan must have the approval and full cooperation of both supervision and labor. Each of these segments of the organization often approve and promise to cooperate, even though they do not fully understand the plan nor know what their responsibilities are. Needless to say, commitments made under these conditions are seldom fulfilled. Management should, therefore, initiate and carry out a program for instructing both the foremen and labor's representatives in the basic principles of time study, how the rates are determined, and the part that each of them must play in the administration of the plan.

Some foremen believe that the use of wage incentive relieves them of all responsibilities so far as production per man-hour is concerned. This supposition is false. Although the wage incentive does offer an inducement for the workman to produce more, the foreman must be always watchful and maintain standard working conditions. Flasks, patterns, machines, core boxes and all other equipment must be frequently inspected and repaired if they are in poor condition.

All delays beyond the control of the workman must be held to a minimum; otherwise he is unable to produce to the extent of his ability and has just cause for grievance. These grievances, when processed, result in either rate adjustments or special allowances. In either case the final result is higher unit costs.

The wage incentive is by no means a one-sided affair. Labor, as well as management, must make a contribution if success is to be assured. Labor's contribution is more output per man-hour. The officers and shop stewards of the local union should then cooperate with management and explain to the workmen that wage incentive means more pay for more work, and that only by producing more than the fair standard for normal effort, which is determined by time study, can they earn higher wages.

The Need for Standards

Payment of wages on the basis of output necessitates rate setting. These rates are expressed either in terms of time or money per unit of production, depending on the type of incentive plan used. In either case they should be based on standards for normal effort.

Standards for normal effort are usually called "production standards." They express the amount of work that should be done per hour if wages are paid on

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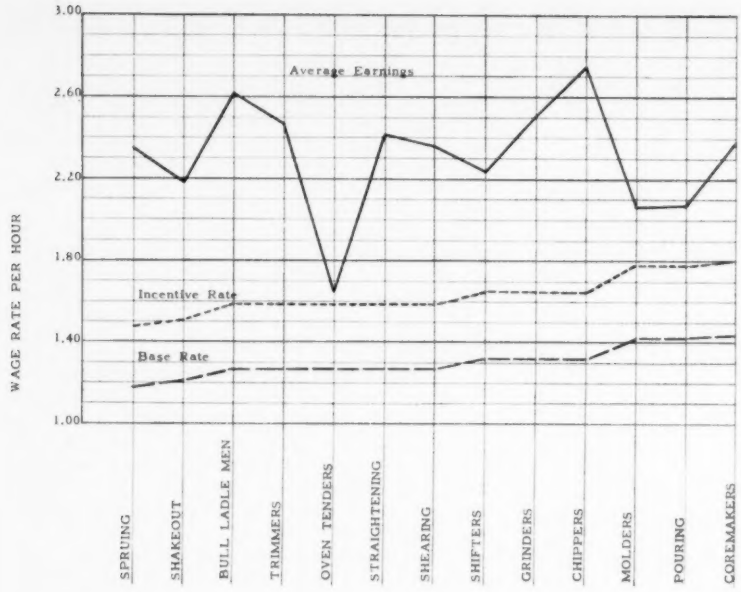

Fig. 1—Graph plotted to show base rate, incentive rate, and average hourly earnings for each job under incentive rates.

the basis of time rather than output. These standards, if properly determined, should not be changed unless the method of doing the job is changed to the extent that either more or less work is involved.

Production standards are then the foundation of the wage incentive. They not only influence wages, but also costs and selling prices. Consequently, they must be fair to both labor and management. Fair standards cannot be determined by mere guesswork, but should be determined by competent time-study men using approved time-study methods.

Time-Study Procedure

So much has been written about time-study techniques that it would take considerable time to adequately present a further contribution on the subject. However, some essential details which should not be overlooked or neglected by time-study men will be first mentioned and later emphasized. They are as follows:

1. Time study should be preceded by process analysis.
2. Each element of work should be timed separately instead of timing the job as a whole.
3. Rates should be supported with detailed specifications of method and work to be done.
4. Adequate procedures for counting production should be provided.
5. The reasons for downtime and special allowances should be reported.

Unless time study is preceded by process analysis, the proper time for doing the job cannot be determined. Process analysis, in this case, means checking the process before the job is timed to see that everything affecting time is in order.

All the equipment used in the operation must be in good working condition. This may include molding or core machines, flasks, patterns, core boxes and power tools. Sufficient power or air to properly operate the machines must be available. The working area must be neat and orderly. Tools, supplies, flasks, bottom boards and core plates must be easily accessible so that they can be obtained without undue effort on the part of the workman.

Next, but equal in importance to checking the equipment, comes checking the elements of work required to do the job properly. In molding, for example, elements such as riddling, peening, and venting should not be left to the discretion of the molder but should be decided by the foreman.

Timing each element of work involved in an operation is generally accepted as better than timing the job as a whole. The purpose of time study is to determine the normal or standard time required to do the job. It is doubtful, at least in the author's mind, if this can be done by applying a rating factor, which is the result of judgment by the time-study man, to the over-all time. Instead, he should break the job down into elements or work motions and then record the time for each element. By analyzing time studies that are made in this manner the time for similar elements can be compared with other time studies and thus minimize guesswork in rating the workman's speed or effort.

The foregoing method has several other advantages. First, data can be collected and compiled in such a manner that standard times for many operations, including coremaking, molding, shearing off gates, grinding and straightening, can be set before the jobs are put into production. This is especially advantageous for foundries that have small lot orders which may be processed before the operation can be timed.

Second, the use of element standard times enables the time-study department to quickly and equitably adjust rates, without further time study, if the method of doing the job is changed to the extent that elements

of work are either eliminated from or added to the job.

Third, the use of such data results in the standard times for all jobs having the proper relationship between them according to the work content of each job. This is very important because the fairness of rates is usually determined by comparing the rate for one job with that for a similar job.

Fourth, element standard times can be used to predetermine rates for new methods of operation. Among the most successful mechanization programs that the author has seen were those where the rates for molding, pouring, shifting and shakeout were set from element standard times before the mechanized unit was put into operation. This avoided operating on a day-work basis and overmanning the operation until the various jobs were timed and new rates set.

Rates should be supported with written specifications describing the equipment to be used and explaining in detail the work to be done. The work to be done can best be described by showing the elements of work and their respective standard times that were used in determining the total standard time for the job. These specifications not only serve as instructions for the foremen and workmen, but also provide factual data for settling disputes over rates if they arise.

If wages are based on output, it is obvious that the units produced must be accurately counted before correct payment can be made. Nevertheless, some foundrymen are negligent and do not obtain accurate counts after each operation.

Accurate counts can usually be obtained by the use of well organized procedures without incurring any additional expense. In some cases the purchase of an additional scale or the employment of a clerk may be required. Even so, the results will probably fully warrant the expenditure.

Payment for downtime or time lost by an incentive worker due to delays beyond his control is costly. Furthermore, it is the subject of many grievances and controversies between supervision and workmen. In order to minimize the downtime, the plant manager must first know the causes. Procedures should then be developed to give him that information.

These procedures include the use of forms on which the foremen write in the workman's name, the amount of lost time, and the reason. Each foreman must cooperate in this undertaking and clearly state the reason even though he is at fault. These reports then provide the payroll department with the information needed to make correct payment and also give the manager the information needed to correct the causes and reduce downtime to an absolute minimum.

Organizing the Time-Study Department

Since the success of the wage incentive depends so much on time study, management should be careful when selecting the personnel for this work. It is not a job that can be done by men who have had neither previous experience nor special training. Yet we know of cases where management has delegated the responsibility of time study to men who did not know how to do the work and were not especially interested in learning.

To do the job well, a time-study man must first of all be interested in his work. In addition, he must possess not only the technical knowledge necessary to make and analyze time studies, but also certain personal characteristics. He must be able to get along with other members of the organization. Moreover, since his activities influence management-labor relations, he must gain the confidence of labor in his integrity. He must, therefore, be able and willing to tactfully answer all questions pertaining to time study.

The procurement of competent time-study personnel is a difficult problem, especially in small foundries where the activities may only require the services of one man. Nevertheless, it makes no difference whether the personnel consists of one man or ten. It still must be fully qualified to do the job properly.

If management does not have fully qualified men in the organization it should engage professional services to organize its time-study department and give its personnel some preliminary training. These services should later be supplemented with periodic services for the purpose of checking the activities of the department and helping solve some of the difficult problems as they arise.

Extended Use of Wage Incentives

Many foundries limit the use of wage incentives to coremaking and molding. This is not always wise because the other employees may feel that they too should have the opportunity to earn higher wages. Unless they are given this opportunity they will probably demand higher base rates without proportionately increasing their output. Management should then seek to improve its relationship with labor by developing sound incentive plans for as many operations as possible.

Sound incentive plans can be developed to cover almost every operation in the foundry. Individual plans, whereby each workman is paid in proportion to his own efforts, should be used wherever the production of individuals can be counted. These operations vary according to the type of foundry. They generally include molding, coremaking, core assembly, shearing, grinding, chipping and straightening. Group plans, whereby each workman is paid in proportion to the effort of the group as a whole, have been successfully used for operations such as melting, pouring, shifting, shakeout, tending ovens, sorting, and shipping.

The use of incentives is by no means limited to production workers. They can likewise be used successfully to obtain better effort on the part of supervisory personnel. Some managements distribute a portion of the annual earnings to the key men of the organization —including foremen—on a more or less arbitrary basis. While this type of incentive may invigorate the top-flight executives, it is doubtful if it stimulates better effort on the part of the foremen.

In the first place, many items over which the foreman has no control influence profits. For example, selling prices, volume, selling and administrative expense, and fixed charges all affect the profits of a company. As the foreman is not concerned with such items, he may believe that the payment of the incentive is a matter of chance instead of being dependent on his efforts.

In the second place, incentive payments that are made annually are too far apart to cause very much

enthusiasm except once a year. To be really effective, incentives for supervisors should be based on the performance of the men who participate in the plan. The performance of each department can be measured by comparing the actual amounts with standard allowances for labor, scrap, downtime, and indirect labor. Gains or losses over these standard allowances are then evaluated to determine the amount of incentive earned by extra effort on the part of the foreman.

Whether the incentive should be based on the individual performance of each foreman or on the combined performance of all the foremen is debatable. Since the successful operation of a foundry depends so much on the cooperative effort of all the foremen, we believe that the results of each department should be measured separately, in order to detect weakness, but that incentive payment should be based on overall results.

TABLE I—BASE AND INCENTIVE RATES, AND AVERAGE EARNINGS

Job Classification	Base Rate	Incentive Rate	Average Earnings	Average of Base, %
Spruing	1.18	1.48	2.35	200
Shakeout	1.21	1.51	2.19	181
Bull Ladle Men	1.27	1.59	2.62	206
Trimmers	1.27	1.59	2.47	195
Oven Tenders	1.27	1.59	1.65	130
Straightening	1.27	1.59	2.41	190
Shearing	1.27	1.59	2.36	186
Shifters	1.32	1.65	2.24	170
Grinders	1.32	1.65	2.51	190
Chippers	1.32	1.65	2.74	208
Molders	1.42	1.78	2.06	145
Pouring	1.42	1.78	2.07	148
Coremakers	1.44	1.80	2.38	165

The wage structures of many companies contain inequities which are the result of either the foremen setting the base rates in their respective departments by arbitrary judgment, or by collective bargaining between management and the workers without the aid of job analysis. In the development and administration of a wage incentive plan it is just as important to have sound and equitable base rates as it is to have sound and equitable production standards. It is the combination of these two factors that determine the rate of pay per unit of production and govern wages. The full cooperation of a workman is unlikely unless he believes that his base rate is fair in comparison with the rates for other jobs. If he should ask why job *A* pays three cents per hour less than job *B*, management should have data in clear and complete form to substantiate the three-cent differential.

Job evaluation provides management with that type of information. Job evaluation is a technical procedure that requires experience and fairness. It involves analyzing each job and grading its essential characteristics in a systematic way to determine its value in relationship to all other jobs. When properly done, job evaluation provides labor and management with a yardstick to determine the base rates for each job in the plant.

In order to clearly show the results of bad practices in the development and administration of a wage incentive plan, Fig. 1 is presented as a graphic picture of an actual case history. The graph shows the base rate, incentive rate, and the average earnings per hour for each job where incentives were used. The points that are plotted on this chart are also shown in Table 1.

The base rate for each job was determined by collective bargaining between the company and the workers. These are in line with the industry rates and reflect fairly well the proper differentials between jobs. The incentive rates were also the result of collective bargaining and are 25 per cent higher than the base rates. Before going further, let us examine the significance of incentive rate.

Incentive rate means the amount of money per hour that an incentive worker can earn by applying more effort than is expected of him if he is paid by the hour rather than on the basis of output. In actual practice, this will vary for individuals according to the degree of skill that they possess and the amount of effort that they apply. The incentive rates shown in Table 1 represent what can be earned by the average worker. In this case, it means that the rates per unit of output are set at such a level that the average worker can earn approximately 25 per cent more than his base rate.

Example of Poor Administration

Let us now look at average earnings. The amounts shown in Table 1 and on the chart (Fig. 1) are not the highest for individuals, but are the average earnings per hour for all the men who worked at the operation. These amounts can then be considered as the actual earnings of an average worker.

The relationship between average earnings and base rates are expressed percentagewise in the last column of Table 1. They range from 130 per cent of base rate for oven tenders to 208 per cent for chippers.

Two conclusions can be derived from this picture. First, that all of the workmen engaged in the operations were far above average. Second, that the rates per unit of output were improperly established. The first conclusion would be false, because the production per man-hour in this plant was among the lowest in the industry for the comparable class of work. This wage incentive plan then accomplished only one of the three purposes which should be management's and labor's objective. It resulted in higher wages but failed to gain greater output and lower unit costs.

Before discussing the effect that these high wages and low production had on the affairs of the company, let us discuss profit. The object of every business is to make a profit. Profit, then, should not be considered as a leftover but should be carefully planned and be the first instead of the last consideration of management.

Profit planning begins by examining the behavior of each item of expense and resolving them into their variable and fixed portions. However, in business we deal with three classes of expense. These must ultimately be reduced to two:

1. Fixed expense—items which do not change with activity.

2. Variable expense—items which increase or decrease in proportion to activity.

3. Mixed expense—these items are partly variable and partly fixed. Therefore, it is necessary to separate the mixed items into their variable and fixed portions

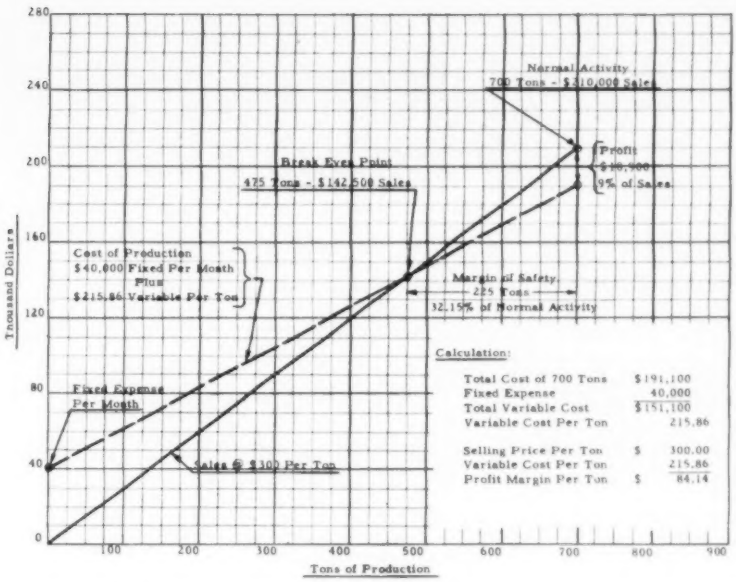

Fig. 2—This chart illustrates the use of the total fixed expense in planning the profit for a malleable foundry having a fixed expense of $40,000 per month and production capacity of 900 tons per month.

so that the fixed portion may be added to the amount of expense for the wholly fixed items. By this process we have finally resolved all expense into two classes, namely, fixed and variable.

Figure 2 shows how to use the total fixed expense in planning the profit for a malleable iron foundry that has $40,000 per month fixed expense and a capacity of 900 tons per month. In this illustration, we have assumed that the objective of management is to make a profit equivalent to 9 per cent of sales when the plant is operating at 77.8 per cent of capacity. We have further assumed that the average selling price is $300 per ton. The essential facts shown on the chart are then based on producing 700 tons per month (having a sales value of $210,000) and making a profit of $18,900.

Must Know Profit Factors

The diagonal line beginning at zero on the vertical and horizontal scales of the chart and extending to a point representing $210,000 on the vertical scale and 700 tons on the horizontal scale shows the sales value of production. It is obvious then that to make a profit of $18,900 per month, the 700 tons must be produced at a total cost of $191,100, or the difference between $210,000 and $18,900. In order to achieve this objective it is essential that management know:

1. What the variable cost per ton must be in order to make the expected profit.
2. The margin of profit per ton, which is the difference between the selling price and the variable cost.
3. The break-even point or the activity required so that revenue from sales equals cost of production.

The variable cost per ton is determined by dividing the difference between the total cost and the fixed expense by the tons produced. In the illustration (Fig. 2) this is shown as $215.86. The margin of profit is then $300.00 minus $215.86 or $84.14. In other words, if the planned profit is to be realized, management must be watchful to see the difference between the average selling price and the variable cost is not less than $84.14 per ton.

The break-even point is determined by drawing another diagonal line on the chart (Fig. 2). This line begins at $40,000 and extends to a point representing $191,100 on the vertical scale and 700 tons on the horizontal scale. This line shows the cost of production. The point where it crosses the line that shows the sales value of production is the break-even point. On the chart the break-even point is at 475 tons and $142,500 sales.

Between the break-even point and normal activity is the area of margin of safety. This is shown on the chart (Fig. 2) as 225 tons, which is 32.14 per cent of 700 tons. In other words, if the variable cost per ton is controlled and the average selling price remains at $300 per ton, activity can decline 32.14 per cent below normal before losses would be incurred. On the other hand, if the average selling price declines, variable costs must be reduced to maintain a profit margin of $84.14 per ton.

Returning to our case history, we find a company whose variable costs were $240 per ton. This was due to poorly developed incentive plans and the lack of managerial controls. Thinking that additional volume would solve the dilemma, management quoted prices which resulted in reducing the average selling price per ton from $300 to $280.

Figure 3 shows the profit pattern of the company under these conditions. By drawing the two diagonal lines representing cost of production and sales revenue, we find that their paths would not cross until 1,000 tons per month had been produced and sold. This means that the break-even point was 100 tons beyond the capacity of the plant. The only solution to this problem is a reduction in variable costs which, in this case, means greater production and decreased labor costs.

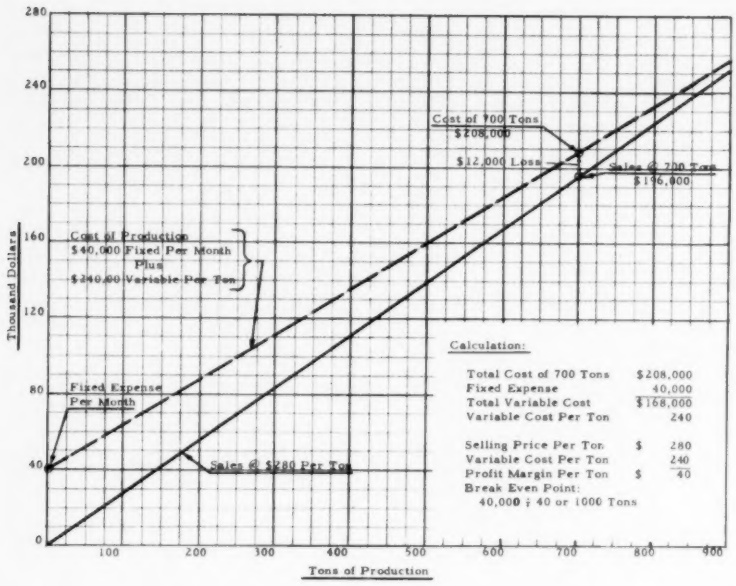

Fig. 3—The profit pattern, charted under conditions of increased variable cost and reduced selling price, shows that the break-even point would be 1000 tons, or 100 tons beyond total capacity of the plant.

Thus far the discussion on time study has pertained to wage incentives, but it can be used to advantage in supplementing other activities in the organization—estimating, cost control, and scheduling.

Time Study Aids Other Activities

Estimating: In estimating the cost of producing a casting consideration must be given to the cost of material, cost of direct labor, and the indirect expense. It is in estimating the cost of direct labor and the indirect expense that a well organized time-study department can make a worth-while contribution.

In order to estimate the cost of direct labor within a reasonable degree of accuracy, it is first necessary to thoroughly analyze either the drawing or pattern for the casting and then prescribe the exact process to be used for each operation. This should be done by the time-study and methods department in collaboration with the foundry superintendent. By using the combined knowledge of the time-study and manufacturing departments, the best and most economical methods are more likely to be determined. After the process for each operation has been prescribed, the time-study department can accurately determine the time and cost for each operation by the use of element standard times and standard base rates.

Indirect expense is estimated by the use of overhead rates which are determined by the cost department. These rates are usually based on past performance. As this type of expense includes indirect labor, rates based on past performance are often incorrect.

Overhead rates should be based on the amount of expense required to operate a department under good supervision. The time-study department should, therefore, determine the amount of indirect labor required for various levels of activity. With this information the cost department can then develop more accurate overhead rates for each department.

Cost Control: Stated briefly, cost control involves three major actions: (1) making a comparison between actual and estimated costs to determine what variations have occurred; (2) determining what caused the variation; (3) revising methods or practices to correct the unfavorable conditions.

The best way to simplify cost control is to prevent as many unfavorable variations as possible. No doubt, most of these are due to excess scrap, but many variations are due to poor utilization of labor. These can be prevented if the foreman has the proper information in regard to the number of men required for each job in his department. A progressive time-study department can provide that information by determining the proper crew size for each job in the plant.

Better utilization of labor can also be obtained by making work schedules in advance. To do this intelligently the works manager should know the amount of work ahead of each department in terms of man-hours. He could then either increase or decrease his working force as required, and thereby minimize premium pay for overtime and also overmanning any of the operations. By using the production standards that were developed for wage incentives, all work ahead can be evaluated in terms of man-hours, providing information needed to make advance work schedules.

Scheduling: The time required to perform the operations must be planned in advance. Intelligent planning requires knowledge of: (1) amount of work, in terms of man-hours, that is ahead of each department; (2) time required to perform each operation necessary to manufacture the product; (3) lead time required on one operation before the next operation is started.

This information can be obtained through the use of production standards that were developed for wage incentives. Scheduling can then be done in such a manner that the manufacturing operations can be performed with minimum delay and confusion.

Questions and Answers — THE ROUND TABLE

Gray Iron Below Zero

We should greatly appreciate any information you can send pertaining to the use of gray iron pressure castings at sub-zero temperatures. We have in mind particularly castings for use in pumps.

Efforts to find much information on this subject have been unsuccessful. Perhaps some AMERICAN FOUNDRYMAN reader has data he will pass on by way of The Round Table. One bit of data indicates that cast irons, which have inherently low impact strength, suffer a gradual loss of 10 to 15 per cent down to temperatures of about -80 F. Specimens cooled to subzero temperatures but tested at room temperature seem to have no loss in impact resistance.

Carbon Equivalent—What Is It?

What is the carbon equivalent, how is it calculated, and what does it indicate? When and where did the term first come into use?

The carbon equivalent, a figure calculated from the composition of a cast iron, is useful in indicating and studying behavior of cast irons. It bridges the gap between the iron-carbon equilibrium diagram and practical foundry operations, taking into account the presence of silicon and phosphorus which are not covered by the iron-carbon diagram.

Carbon equivalent is a very good index of fluidity and required pouring temperatures. It is not of much value in predicting strength since the scatter is large. Nor does it correlate very well with chilling tendency, especially in these days of inoculation.

One per cent of silicon or phosphorus is approximately equivalent to 0.3 per cent of carbon as far as foundry application of the iron-carbon diagram is concerned. Manganese and sulphur generally are present in proportions which cancel each other and in usual amounts can be disregarded. To calculate a carbon equivalent the percentages of carbon, silicon, and phosphorus are used in one of the two commonly accepted formulas:

$$C_e = C + 1/3\ (Si + P)$$

or

$$C_e = C + 0.3\ (Si + P)$$

I prefer the latter but it makes comparatively little difference within normal ranges of silicon and phosphorus.

A calculation shows how the carbon equivalent is used. Assuming that the composition of the iron is C, 3.40 per cent, Si, 1.50, and P, 0.80, C_e (using the second formula) is 4.09. Behavior of the cast iron as far as fluidity and related phenomena are concerned will be essentially that of iron containing 4.09 per cent carbon. Reference to the iron-carbon diagram indicates that the metal would start to freeze at about 2160 F.

A variety of factors have been used in the development of the carbon equivalent idea. Fletcher used $C + 0.286\ Si + 0.387\ P + 0.048\ (Mn - 1.8\ S)$. Bolton started out using $C + \frac{1}{2}\ (Si + P)$ and I originally used a factor of $\frac{1}{4}$.

Brinkman and Tobias used $C + 0.312\ Si + 0.33\ P - 0.066\ Mn$. Bordoni tried to account for all the alloys with $C + 0.312\ Si + 0.33\ P - 0.078\ (Mn - 1.8S) + 0.156\ Al + 0.125\ Ti + 0.109\ Ni + 0.0935\ Cu - 0.0935\ Mo - 0.312\ Cr - 0.62\ V$. We tried this on a high alloy corrosion resisting iron and it was woefully off; in the low alloy field it probably would be fairly accurate.

JAMES T. MACKENZIE, *Tech. Dir.*
American Cast Iron Pipe Co.
Birmingham, Ala.

Finishing Pipe Couplings

We make malleable iron pipe couplings and are having trouble finishing the ends. On one end the gate is attached and on the other end we have little fins. We have tried using sprue cutters but without satisfactory results and are now considering using a two-wheel grinder. The couplings run from about 1 in. to 2½ in. in length for nominal pipe sizes from ¼ in. to 2 in. We will appreciate your suggestions and your comments on the value of a two-wheel grinder.

If a straight cut is permissible more experimental work with the shearing should be done, using a cutter that takes most of the gate off on the first cut and followed with two or three broach blades on the face of the same cutter to finish trimming.

If this isn't satisfactory, probably the fastest method would be with two large disc grinders mounted at the right distance apart with a driven clamping or holding wheel-fixture between them and a holding or clamping chain half way around the circumference of the wheel. With this arrangement and by having the emery wheels adjustable, different lengths could be ground in the same machine. This is used satisfactorily in many plants for grinding axle shafts and other parts to proper length.

It is a simple arrangement and requires no clamping

of the part. The operator merely loads the fixture which clamps and unloads automatically. It would be possible for one operator to run at least two machines. The arrangement can be set up for disc grinders or milling cutters.

If the ends of the couplings need to be finished to an OD radius and an ID chamfer, a two-wheel grinder or milling cutter, appropriately dressed or ground, could be used. The two heads should be individually driven, one stationary, the other moved with a hand lever. Then by holding the coupling in a floating chuck between the two heads, pulling the movable wheel or cutter against one end of the coupling, the other end would be moved into contact with the other wheel or cutter.

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Belle City Malleable Iron Co.
Racine, Wis.

Foundry Research Ideas

One of our graduate students is interested in a research project on ferrous metallurgy, particularly cast iron. He is working toward a master's degree, so the time available is more limited than if he were working for a doctorate. We shall appreciate any suggestions you have. Our equipment is adequate except perhaps for problems involving x-ray diffraction or a long range melting schedule, although we might be able to work out an arrangement with some nearby foundry for melting.

FOUNDRY RESEARCH PROJECTS, developed by the College Research Projects Committee of the A.F.S. Educational Division, contains suggestions for 39 projects on all phases of foundry technology. Presented with each topic is a discussion of the problem, value of the results, suggested procedures, and facilities required. Topics have been suggested for doctorate problems, master's problems, group problems which can be conducted by a class throughout a school year, and commercial foundry research. The Committee will assist in arranging cooperation with foundries and in securing publication.

Causes Of Pinholes

What factors cause pinholes in gray cast iron?

According to the A.F.S. ANALYSIS OF CASTING DEFECTS, pinholes may be caused by (1) excessive moisture in the molding sand, (2) excessive permeability combined with high moisture content sand, and (3) presence of critical amounts of aluminum or other non-ferrous metals in the iron.

Excessive moisture in the sand, particularly combined with high permeability, causes rapid evolution of steam which may be injected into the metal at the instant of solidification.

Small amounts of aluminum and other non-ferrous metals may find their way into the metal in a form of automotive pistons and aluminum parts in poorly prepared scrap, aluminum in bundled steel scrap, nitirding steels of rather high aluminum content in the steel scrap, ferro-alloys, scrap copper, contaminated briquetted borings, etc.

Generally speaking, soft irons of high carbon and silicon content tend to have a rather low tolerance for aluminum, particularly when poured into light sections. Harder grades of metal used in heavier sections exhibit a much greater tolerance for this element. Also, metal melted under fairly oxidizing conditions has a great deal more tolerance for aluminum and is less likely to show pinhole defects than metal melted under cupola conditions tending toward the reducing side. (EDITOR'S NOTE: See Letters-to-the-Editor page 149, for more on aluminum in gray iron.)

RALPH A. CLARK, *Met. Eng.*
Electro Metallurgical Div.
Union Carbide & Carbon Corp.
Detroit

BIRMINGHAM CHAPTER'S "STAR REPORTER" EXHIBITS HIS HANDIWORK

J. P. McClendon, Stockham Valves & Fittings, Inc., (second from left) one of the most active and capable of A.F.S. Chapter reporters, exhibited specimens of his editorial and photographic work at the recent Birmingham Regional Foundry Conference. Interested onlookers are, starting left: Edgar A. Brandler, Electro-Metallurgical Div., Union Carbide & Carbon Corp.; William W. McCulloch, American Cast Iron Pipe Co.; and M. L. Carl, Sloss-Sheffield Steel & Iron Co., all of Birmingham, Ala.

OPTIMUM ALUMINUM ADDITIONS IN COMMERCIAL YELLOW BRASS

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and
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Barber, N. J.

IT HAS LONG BEEN THE CUSTOM in many foundries making yellow brass castings to add small amounts of aluminum to the metal prior to pouring. The reasons usually given for making such additions are that the aluminum is necessary to improve the fluidity or castability of the metal, and also to improve the surface finish on the castings made in sand.

While the advocates of adding aluminum to yellow brass in the foundry are numerous, a large number of shops consider this practice as highly detrimental to making quality castings. In fact, some foundries contend that additions of aluminum to yellow brass make it impossible to obtain a satisfactory polished surface on the casting. Other foundrymen claim that aluminum offers no advantages and should be kept out of the metal.

As is the case in many controversial foundry practices, practically no experimental evidence is available for evaluating the effects of aluminum in yellow brass. While the subject has been discussed occasionally in the literature, no controlled experiments have been made to determine the exact effects of aluminum additions in order that the controversy be settled on the basis of experimental data rather than opinion.

One reason why definitive studies may not have been made was the lack of accurate analytical methods for aluminum when present in small amounts. Improved techniques recently developed suggested the possibility of studying this problem with a degree of accuracy.

Castability Improved

Observation of the effects of adding aluminum to commercial yellow brass alloys in a large number of foundries indicated that a definite improvement in castability was obtained when aluminum was added to the metal. By castability or fluidity is meant the ability to fill the mold completely and run the metal satisfactorily into very thin sections. At the same time a number of observations have been made as to the harmful effects which may result from the presence of aluminum, particularly in hardware shops.

It has been observed that the addition of aluminum to the yellow brass or the presence of aluminum in the metal can produce poor surfaces as well as oxide films which may interfere with finishing and polishing.

Preprint No. 50-16. This paper will be presented at a Brass and Bronze Session of the 54th Annual Meeting, American Foundrymen's Society, at Cleveland, May 8-12, 1950.

Since this type of controversy can continue indefinitely unless some experimental evidence is available for evaluating the claims on either side of the question, it appeared to be worth-while to study this matter in an effort to determine more exactly the effects of aluminum when added to yellow brass.

Two separate problems were involved in designing experiments for this work. The first was to determine the effect of aluminum on the tensile properties of commercial yellow brass. This is the simpler of the two problems and was carried out in the conventional manner. The second problem was to design a test to evaluate the general term "castability" with regard to additions of aluminum in yellow brass.

Castability cannot be simply measured and any test used to evaluate it is necessarily a compromise. It is possible, however, to design a practical test which will give useful information and which will simulate actual foundry practice and produce results which can be translated into recommendations that a foundryman can use. Such a test has been devised in this study. It was hoped to determine whether or not aluminum had a specific effect and if so, what amount of aluminum was required to produce this effect.

Materials Used: Two separate heats of commercial yellow brass known as No. 403 were used in this investigation. The analyses of the two heats were as follows:

Heat R611	
Comp.	%
Cu	67.20
Sn	1.07
Pb	2.42
Zn	28.60
Fe	0.27
Ni	0.36
Sb	0.03
S	0.02
Al	0.008

Heat R776	
Comp.	%
Cu	67.44
Sn	1.17
Pb	2.84
Zn	28.74
Fe	0.37
Ni	0.38
Sb	0.08
S	0.02
Al	0.009

These are comparable heats and since each was used in a separate set of experiments, slight differences in chemical composition are not significant.

Melting Practice: In both experiments the general procedure was to melt the ingot down in a forced draft coke-fired crucible furnace, in a No. 60 crucible. The metal was brought to a temperature where it was flaring slightly, the crucible pulled out of the furnace and castings poured. In the process of pouring castings, the aluminum additions were made, as will be explained later.

Mechanical Property Tests: In order to study the effect of aluminum content of the yellow brass on the tensile properties of the alloy, the following procedure was used. After the crucible of molten yellow brass was heated nearly to the flare point and the crucible removed from the furnace, the top surface was skimmed

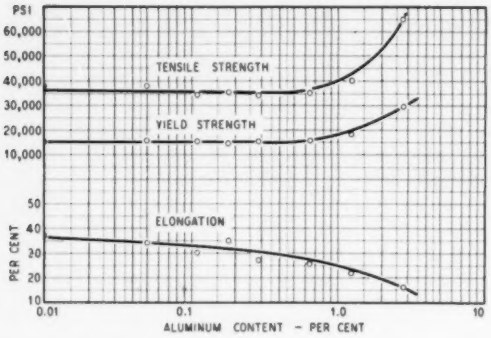


Fig. 1.—Data from Table 1 are plotted to show the effect of aluminum content on the tensile properties of yellow brass. It was necessary to use the logarithmic scale to include the full range of aluminum contents.

TABLE 1—EFFECT OF ALUMINUM ON THE TENSILE PROPERTIES OF YELLOW BRASS

No.	Aluminum Content, %	Tensile* Strength, psi	Yield Strength, psi	Elongation, %
59-1	0.008	37600	14900	37
59-2	0.05	38000	15500	34
59-3	0.11	34250	15000	30
59-4	0.18	35500	14500	35
59-5	0.29	34250	15250	27
59-6	0.65	35000	15750	26
59-7	1.28	40000	18500	22
59-8	2.81	65000	29750	16

*The tensile properties are the average of two bars tested for each aluminum content.

and standard ingot molds were poured. Ingot molds were used rather than cast test bars in order to minimize foundry variables, since only the metallurgical effects of aluminum on tensile properties was desired.

The first mold was poured with no aluminum addition, as a head sample. To the remaining metal in the crucible 0.04 per cent pure aluminum wrapped in copper foil was plunged into the bottom of the crucible and allowed to dissolve in the metal. Two standard ingot molds were then poured. To the remaining metal in the crucible another increment of aluminum was added in the same fashion and ingots poured. This process was followed until all the metal in the crucible had been poured into ingot molds. This procedure gave a series of standard ingots with increasing aluminum content.

Two standard 0.505-in. test bars were cut from the bottom portion of each ingot and broken on the Baldwin-Southwark hydraulic testing machine. Tensile strength, yield strength, and elongation in 2 in. were measured. Drillings for chemical analysis were taken from the top surface of the ingot from a number of locations in order to minimize the possibility of segregation.

Castability Tests: For purposes of estimating the effect of aluminum additions on the castability of yellow brass, a test was devised using as a pattern a letterplate casting. This casting is approximately 1/16 in. thick, 8 in. long, and 2 in. wide. Two such castings were made in a single mold, gated as shown in Fig. 2. The gating arrangement is considered poor from a manufacturing standpoint, but was quite satisfactory for test purposes.

The test consisted of making aluminum additions to the crucible of yellow brass and pouring test castings. Increasing increments of aluminum were added and castings poured until the entire 200 lb in the crucible had been poured out. The first castings poured had no aluminum added and the increments then were 0.005, 0.01, 0.03, 0.05, up to 0.5 per cent aluminum added. From these test castings it was hoped that information on the effect of aluminum on castability could be obtained.

In Table 1 are listed the results of the tensile tests of the bars machined from ingots containing various amounts of aluminum. These data are plotted in Fig. 1. Figures 2 and 3 are photographs of the test castings used to determine the effects of aluminum on castability. Figure 2 shows the casting itself from the cope side with gates and risers included, while Fig. 3 shows only the drag side of the casting. Both views are included since they give a better indication of the effect of aluminum additions than would a single picture.

It can be seen by reference to Table 1 and Fig. 1

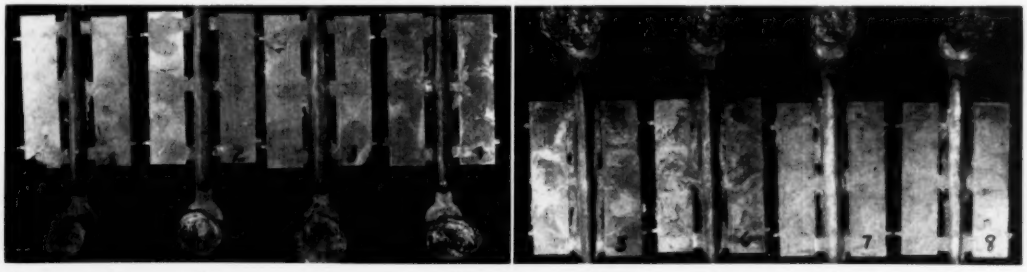
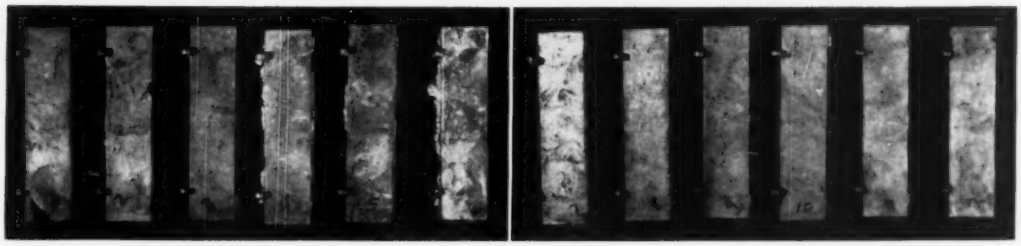


Fig. 2—Cope sides of the test castings show the effect of increasing aluminum content on castability. As the aluminum content increases the oxide films become more pronounced and the castability greater until (No. 8) the film is fairly uniform and gives the best appearance of those shown. The color of the casting changes from red to red+silver+black to gold+silver to golden at No. 8. No. 1 and 2 had poor castability.



No.	1	2	3	4	5	6	7	8	9	10	11	12
Al, %	0.009	0.013	0.018	0.026	0.034	0.051	0.062	0.16	0.188	0.235	0.279	0.371

Fig. 3—The effects of aluminum contents on castability are shown by the drag sides of the yellow brass test castings. Castings No. 1-7 show change from no aluminum oxide film through discontinuous thin films, to an unbroken film at No. 8; castings No. 9-12 show results of increasing amounts of aluminum—the films become visibly thicker, non-uniform and more silvery in color. Aluminum content is shown below each casting.

that, generally speaking, aluminum is a beneficial addition to yellow brass. The tensile and yield strengths are relatively unaffected up to about 0.5 per cent aluminum, and then increase rapidly. The elongation decreases slowly as the aluminum content increases, dropping off about 10 per cent with the first 0.5 per cent of aluminum added.

This means that the ductility normally associated with yellow brasses can be reduced considerably if excessive quantities of aluminum are added to the metal. Certain applications of yellow brasses require ductility. This reduction in elongation found in these tests may be significant for the applications where lower ductility would impair the usefulness of the material.

It is not too surprising that aluminum has a strengthening effect in yellow brass. Since manganese bronze alloys are substantially 60-40 yellow brass with about 1.0 per cent aluminum added, it would be expected that the strength of this metal would also be improved by aluminum additions. It is also to be expected that an increase in strength would be accompanied by a decrease in ductility.

Full Addition Range Covered

It should be pointed out that it was necessary to plot the data on logarithmic paper in order to include the aluminum contents from the very lowest up to the maximum. This type of plotting may give an erroneous impression about the effect of the aluminum.

The change in elongation is a very gradual one and even at 0.5 per cent aluminum addition the ductility has not decreased severely. Consequently, it appears that 0.5 per cent aluminum is a critical addition, considering reduced ductility and increased strength. This should be kept in mind with regard to the effect of aluminum on castability, since it more or less sets an upper limit on the amount of aluminum that can be tolerated in the metal without changing the properties markedly.

In considering the results of the castability test, it would have been desirable to have some method of measuring quantitatively the effect of aluminum on the yellow brass. Several attempts were made, but none of the methods tried gave results which had any great significance. Instead, observations of the castings were made and from the chemical analyses of the castings an attempt was made to correlate the findings with the aluminum content of each of the castings. The results of these chemical analyses are listed in the captions of Figs. 2 and 3.

From study of the castings, the following observations were made:

1. When the metal was first taken out of the furnace it was flaring greatly. This was before any aluminum addition. This was the hottest metal and yet, when poured into the first mold, a misrun occurred. The metal cooled considerably while successive castings were poured with increasing aluminum additions. It is worth pointing out that the last casting poured with the coldest metal and the highest aluminum addition ran completely.

2. As previously mentioned, the metal was flaring strongly when removed from the furnace and when the first castings were poured. After the initial aluminum addition the flaring was reduced considerably. Apparently the aluminum oxide film that forms over the surface retards flaring and, since smoke in the foundry can be a considerable nuisance, this phenomenon is of interest.

3. The effects of the first aluminum addition are clearly visible on the casting surfaces as shown in Figs. 2 and 3. The original head sample with no aluminum present had a distinct red color and did not fill the mold. With increasing aluminum contents a silvery-gold film appears on the castings. With a difference of only 0.004 per cent aluminum between castings No. 1 and 2, a considerable amount of this aluminum film can be observed on the flat surface of the casting. As the amount of aluminum increases to 0.018 and 0.026 per cent, etc., the amount of this film also increases. It is not, however, until No. 8 where 0.016 per cent aluminum was found that the film becomes completely continuous and covers the casting so that no film edges are visible on the casting surface.

From these observations, it may be said that approximately 0.2 per cent aluminum seems to be the optimum with regard to film formation. With less than 0.2 per cent aluminum the film seems disconnected and does not cover the casting surface completely. With more than 0.2 per cent aluminum, the film seems to thicken, as apparent from the silvery color of the castings, and may be a source of trouble in the casting.

4. Observation of the castings in Fig. 2 shows another interesting point. The first two castings in the series with low aluminum not only did not completely fill the mold and were cold shut, but also show very small quantities of flash off the center runner. As the amount of aluminum increases the amount of flash also increases—it is plainly visible in all castings from No. 4 to No. 8. This is another indication of the strong effect of aluminum on the fluidity and castability of the yellow brass.

5. It was noticed in casting No. 2 that, although the mold was more or less completely filled, the casting itself had cold shuts. This may have been because the thin aluminum oxide films in the metal stream prevented the metal from uniting in the mold and forming a uniform mass. This may well be one of the dangers of having too low aluminum content in the castings.

An attempt was made to determine the effect of the aluminum additions on the finish of the castings. One plate from each casting had the surface removed on a belt grinder in an effort to find oxide cracks. This test did not provide any information, however, since the finish was probably too coarse to determine any fine oxide films. It has been observed that it is necessary to polish yellow brass to a high finish to detect these trapped films.

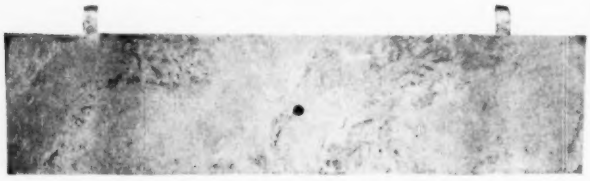


Fig. 4—A typical aluminum oxide film is shown on this commercial yellow brass casting. The surface has a golden color with several distinct areas where the oxide film is mottled black and silver. Thin films of this type are frequently trapped in the metal stream, and show up during polishing as fine hairline cracks which are cause for rejecting casting.

One of the commonest objections made to using aluminum in yellow brass to improve castability is that it is impossible to get a good finish on a casting where the metal has had aluminum added. This is entirely possible and is verified by this work. It is necessary to have a rather carefully controlled aluminum addition to prevent the presence of either very thin oxide films or very heavy oxide films, either of which may easily be trapped in the metal and produce defects in the finished casting.

When the aluminum addition ran about 0.2 per cent the film on the surface appeared to be quite uniform, and the casting itself had a good finish. It is an interesting observation that industrial practice in many shops casting yellow brass has tended toward the use of an aluminum addition of about 0.2 per cent. Since this is an empirical solution based on what can be considered a large amount of experience, it appears that the figure of 0.2 per cent is fairly well founded. The evidence from this test confirms such an addition.

An interesting example of the possible harmful effects of aluminum additions is shown in Figs. 4 and 5, which are photographs of commercially made brass letterplate castings. Figure 4 shows the nature of the casting surface when entrapped oxide films are present. Thin black oxide films are associated with gate areas of the casting. The casting in Fig. 5 has been bent 180°; cracks occurred where oxide films are entrapped.

In many cases these films were not detected until the casting had been polished and was then rejected. In this case the difficulty arose when the original charge material had an indeterminate aluminum content; the normal foundry practice was to add 2 oz of aluminum to each 100 lb of melt. When aluminum-free yellow brass ingot was used and the regular aluminum addition made, the castings were satisfactory and no entrapped oxide films were found.

In regard to the question of whether or not aluminum should be added to yellow brass when the castings have to be finished, it can only be said that from these tests it appears that too low aluminum contents or too high aluminum contents may easily lead to trouble. Whether it is possible to satisfactorily control the amount of aluminum is difficult to say.

The evidence given here does indicate, however, that if some knowledge is available as to the amount of aluminum present in the casting and in the metal charged in the furnace, it should be possible to control the aluminum content rather closely. This is especially true if aluminum-free yellow brass ingot is used. Using close control, it does seem possible to improve the castability greatly, reduce the smoke, and improve casting finish by the use of aluminum.

As to the effect of aluminum on tensile properties, it can be seen that the optimum aluminum addition of 0.2 per cent is well within the range where aluminum has any marked effect on the tensile properties. The low addition would have a relatively insignificant hardening effect. It is possible, however, that in addition to hardening the metal with higher aluminum additions considerable trouble might be experienced from trapped oxide films to be found in the casting. The higher the amount of aluminum the more extensive and thicker are the oxide films.

Summary and Conclusions

Experiments have been conducted to determine the effect of aluminum on both the tensile properties and castability of commercial yellow brass ingot. As a result of the data obtained in these experiments and observations made during making the castings involved, the following conclusions can be drawn:

1. Aluminum contents up to 0.5 per cent have practically no effect on the tensile and yield strengths of commercial yellow brass, while elongation is reduced continuously as aluminum content increases. When the aluminum contents are in excess of 0.5 per cent the tensile and yield strengths increase rapidly, accompanied by a more marked decline in the elongation. This is as expected since aluminum is known to strengthen yellow brass alloys, and the lowered ductility will be expected with the increasing strength.

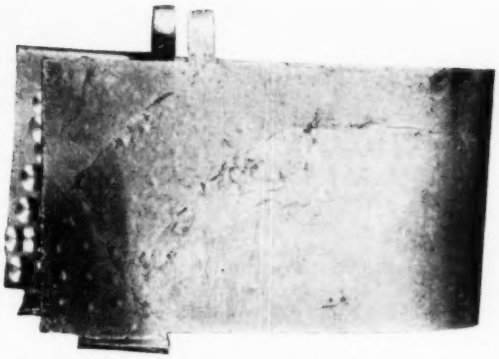


Fig. 5—Bending at 180° revealed the presence of entrapped aluminum oxide films in this casting. Such films frequently show up only after grinding and polishing operations and are cause for rejection. In this case the undesirable effects of aluminum were eliminated when the foundry began using yellow grass ingot with less than 0.01 per cent aluminum contained instead of material of indeterminate aluminum content.

2. It has been observed that the presence of aluminum in casting yellow brass reduces considerably the amount of smoke or flare normally experienced in casting this metal. Also, it has been shown that aluminum increases the castability to the extent that the metal can be poured at a lower temperature than when no aluminum is added. This means that the smoke, or flare, or fume can be reduced to a minimum by using temperatures below the flare point in pouring many castings.

3. In pouring a very thin section test casting it was found that the addition of 0.2 per cent aluminum gave optimum results in filling the mold and in the casting surface.

4. Metal with no aluminum and poured at the highest temperature did not fill the mold completely, while castings with high aluminum and poured at the lowest temperature, out of the same crucible, completely filled the mold and formed considerable flash, indicating that aluminum has a strong effect on the castability of yellow brass.

5. Aluminum additions up to 0.2 per cent gave incomplete thin oxide films which conceivably could be trapped in the metal and cause some trouble. Aluminum additions in excess of 0.2 per cent apparently gave heavier oxide films of a silvery color, which again could be more easily trapped in the metal.

6. The observation that 0.2 per cent aluminum gives optimum results confirms the practice of many foundries which have found by experience that adding this amount aluminum will produce good yellow brass castings with a pleasing golden color.

7. It was not possible to evaluate the effect of aluminum on finishing yellow brass castings. It is quite possible, however, that any aluminum added to yellow brass can produce oxide films which may remain entrapped in the metal and interfere with machining and polishing operations.

8. With the possibility of aluminum oxide film formation due to the use of aluminum additions, it appears necessary to make a careful selection of gating systems for yellow brass castings. In order to obtain the beneficial effects of aluminum in yellow brass, it appears essential to use non-turbulent gating methods which bring the metal into the mold quietly and do not agitate it unduly. By such methods it should be possible to obtain the advantages of aluminum and minimize the risk of such additions.

9. To establish close controls over the aluminum content of yellow brass castings the use of aluminum-free ingot is indicated. If unknown amount of aluminum is present in the ingot it is impossible to obtain consistently uniform castings; also, undesirable aluminum oxide films are apparently found more often when the original ingot material contains appreciable quantities of aluminum than when the only aluminum present is that added in the foundry.

Olivine—Properties and Uses For Refractories and Molding Sands

Natural olivine and olivine rocks, of which there are important deposits in Norway, have valuable refractory properties, despite their content of Fe_2SiO_4 which is extremely fusible in the pure state. The main constituent is Mg_2SiO_4, and Goldschmidt showed that natural olivine rocks with as much as 10 per cent Fe_2SiO_4 could stand up to temperatures (under load) well above 1,700 C.

The development of olivine refractories for industrial uses took place largely from 1928-1931, when refractories were made according to Goldschmidt's methods by transforming olivine rock into a mixture of forsterite (Mg_2SiO_4) and magnesium ferrite. Forsterite bricks are now used in the roofs of copper holding and reverberatory furnaces. In the steel industry they give satisfactory service in the end wall, bridge wall, and other parts of open-hearth furnaces. They are also used in cement and ceramic kilns, according to a summary in *The Refractories Journal*, Aug., 1949.

Although preliminary tests had shown the technical possibility of using olivine as a molding sand, its development followed that of the olivine refractory bricks. Best quality olivine has substantially more refractoriness than quartz, and also shows greater resistance to the scorifying action of iron oxides.

Olivine must be protected from contamination by such materials as quartz sand, granite, felspar, talcum, limestone and aluminous substances. For bonding purposes only certain special clays such as Wyoming bentonite can be used, and then only in small amounts.

One of the advantages claimed is that the inhalation of dust from olivine will entail only slight or no risk of silicosis. This may be due to the fact that, unlike crushed silica, olivine has no free valences in the surface structure of the dust particles.

National Foundry Association Moves

New address of the National Foundry Association since March 25 is Suite 705, Monadnock Bldg., 53 West Jackson Blvd., Chicago 4, Ill. Providing enlarged and better facilities, the new quarters are closer to transportation facilities.

Progress

IN SOCIETY COMMITTEE WORK

RESEARCH AND EDUCATION received major attention in recent A.F.S. committee meetings as Society members met in Chicago, Detroit, Cleveland, Cambridge, Mass., and Ann Arbor, Mich., to hear progress reports and plan future activities. Recent publications and the A.F.S. Convention sessions of the Educational Division were discussed at that division's Executive Committee meeting, held under the chairmanship of the division head, A. W. Gregg, Whiting Corp., Harvey, Ill.

Educational Division Convention sessions announced by Division Vice-Chairman B. D. Claffey, Acme Aluminum Alloys, Dayton, Ohio, all to be held on Tuesday, May 9, are:

10:00 a.m.—Division Business Meeting.

4:00 p.m.—Round Table Discussion on Trade and High School Training.

7:00 p.m.—Educational Dinner. "*Foundry Apprentice Training at Caterpillar Tractor Co.*," F. W. Shipley and B. L. Bevis, Caterpillar Tractor Co., Peoria, Ill., and "*Engineering Student and Summer Foundry Work*," Norman J. Stickney, University of Wisconsin.

Results of the 1950 Apprentice Contest are to be announced at the Annual Business Meeting, Wednesday, May 10, and in the May issue of AMERICAN FOUNDRYMAN according to Contest Chairman Roy W. Schroeder, University of Illinois—Navy Pier Branch.

Preparation of a booklet for indoctrination of newcomers to the foundry industry, suggested by the Publications Committee, was referred to W. H. Ruten, Brooklyn Polytechnic Institute.

Progress on the high school foundry text, now under preparation by Edwin Doe, Brooklyn Technical High School, and the college text, being authored by P. E. Kyle, Cornell University, was reported by Textbook Committee Chairman George J Barker, University of Wisconsin.

Acceptance of a proposal to conduct A.F.S.-sponsored research in gating and risering at Massachusetts Institute of Technology, and discussion of the research program occurred at a meeting of the Gray Iron Division Research Committee under the chairmanship of J. S. Vanick, International Nickel Co., New York.

Emphasizing risering, the program calls for a review of current literature, and a fundamental study of solidification to determine minimum directional solidification requirements, significance of convention currents, effect of directional growth of dentrites, and to develop an improved understanding of mass flow analyzer data.

Results of tests for hot tears using cylinders one-half inch thick and 10 in. in diameter with a square boss on one side were reported by G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind., at a recent meeting of the Steel Division Research Committee. Under the chairmanship of Clyde Wyman, Burnside Steel Foundry Co., Chicago, the committee is directing an investigation of steel casting hot tears at Armour Research Foundation, where the new test casting will be further studied. A report at this year's A.F.S. Convention is contemplated.

A final report on the Malleable Division's research work on best microstructure and technique for selective hardening of pearlitic malleable has been prepared, according to Research Committee Chairman Carl F. Joseph, Central Foundry Div., General Motors Corp., Saginaw, Mich. It will be presented at the 1950 Convention. The Board of Directors has authorized a new project—"A Study of the Effect of Melting Atmospheres on the Behavior of Malleable White Iron."

The Convention report on the Brass and Bronze Division research project, discussed recently at a meeting of the Research Committee headed by Blake M. Loring, Naval Research Laboratory, Washington, D. C., will cover the second year's work at the University of Michigan—where the malleable research project is also conducted—and cooperative work of several foundries. Under development is a fracture test for determining copper-base alloy melt quality.

Chairman J. L. Brooks, Muskegon Piston Ring Co., Sparta, Mich., and the Chill Test Committee met in February to discuss possibilities of finding a standard chill test suitable for all foundries, correlation of chemistry with chill test results, use of the chill test for control, and comparison of results of various foundries using the same chill test. A preliminary program for correlation of test results of irons of a wide range of compositions has been set up.

Blinded Sieves Give Spurious Grain Size Test Results Warns Laboratory

NOT INFREQUENTLY two laboratories test the same sample of sand on the same type of sieving machine but get different results. That this may be due to blinded sieves—which should be carefully guarded against—is shown by the test results below, reported by one of the A.F.S. Sand Division laboratories. The same sample of sand was tested on a new set of sieves, then run on a second set in which the No. 70 sieve showed appreciable blinding. The sample was run twice on each set of sieves; average results are reported.

	Per Cent Retained	
Sieve No.	Old Sieves	New Sieves
6		
12		
20	0.03	0.08
30	0.4	0.4
40	3.6	3.95
50	19.1	20.2
70	51.6	40.5
100	20.1	31.5
140	3.8	3.3
200	0.6	0.2
270	0.1	
Pan		
	99.33	100.13

ECONOMY PLUS FROM VACUUM CLEANING IN FOUNDRIES

J. W. Gaffney
Master Mechanic
Ohio Steel Foundry Co.
Lima, Ohio

A TENDENCY TO TOLERATE certain practices and operations, even though they may be obviously inefficient or impractical, is common in all industries to a greater or lesser extent, and is certainly not uncommon in the foundry industry. Such practices are frequently of long standing, and hence there may be an understandable but not necessarily an excusable lack of initiative toward change or improvement. This is particularly true where the operations involved are not of major importance, and where the tendency to "let well enough alone" has no serious consequences.

Perhaps the most outstanding example of a practice that has been long tolerated in the foundry industry, even though it is obviously inefficient, impractical and even hazardous, is the widespread use of compressed air for various types of cleaning operations involving the blowing off of dust and dirt. Aside from being a costly method of cleaning, the use of compressed air for this type of work lacks more in efficiency and economy than it appears to offer.

Instead of cleaning or removing dust and dirt, compressed air blowing merely moves it about. While it will clean a given area, it does so by making the surrounding area so much dirtier and the air just that much dustier. In short, cleaning with compressed air defeats one of the important goals for which the foundry industry is striving—good housekeeping.

Former Practice Unsatisfactory

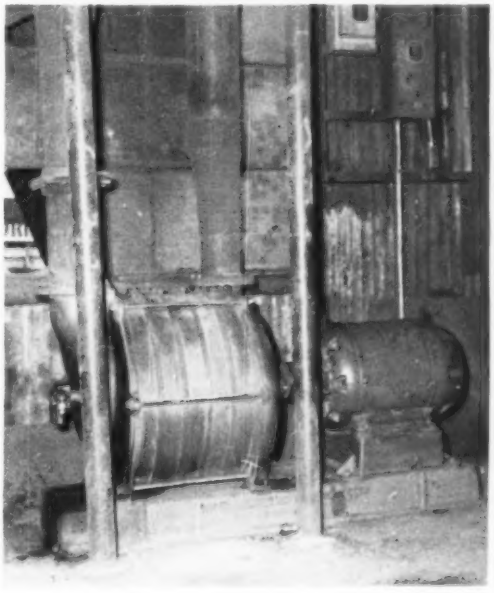
Compressed air was widely used for many years in the plants of the Ohio Steel Foundry Co. for various types of cleaning, including mold and core cleaning. The nuisance value of compressed air cleaning for cores and molds was given particular recognition, especially at the production mold and core cleaning stations where cores and molds for smaller castings are cleaned in a continuous manner.

Each station had two operators using compressed air lines, one during assembly of cores and one at the end for the close-up. This resulted in intermittent but frequent air blasts blowing dust into the atmosphere and enveloping the cleaning stations in a dust fog. Proper cleaning of cores and molds under such conditions was quite impossible. The losses resulting from casting rejects due to poorly cleaned cores and molds emphasized the necessity for change and improvement in these cleaning operations.

As part of the modernization program at the Lima,

Fig. 1—The dust separator is mounted outside the building and discharges directly into a storage hopper.

Fig. 2—A 30-hp motor drives the multistage centrifugal type vacuum producer through a flexible coupling.



Ohio, plant, a 30 hp heavy duty stationary type vacuum cleaning system was installed as a replacement for compressed air cleaning. After 2 years of operation the vacuum cleaning system has proved to be not only more efficient and economical for the actual production work, but for many other purposes.

The vacuum cleaning system has a rated capacity which normally permits six operators to clean simultaneously, each using a nominal 50-ft length of 1½-in. vacuum cleaning hose with an appropriate nozzle. For production type cleaning work shorter lengths of hose are used, and where required hose lengths up to 100 ft can be utilized. The equipment proper consists of a multistage centrifugal type vacuum producer directly connected to a 30-hp, 3450-rpm driving motor, and a 48x96 in. dust separator (Figs. 1 and 2).

The vacuum producer and motor are mounted on a cast iron foundation plate, and are connected through a flexible coupling. The producer maintains a vacuum of approximately 8½ in. of mercury suction and is of the self-unloading type, consuming power in proportion to the air volume handled or the number of operators using the system. Being statically and dynamically balanced, the unit operates without vibration and is practically noiseless.

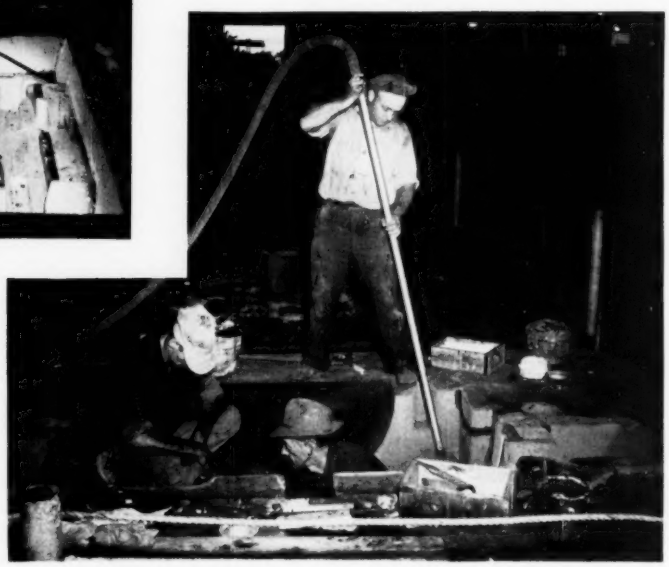
Dust separation is accomplished by a combined centrifugal and inverted bag filter type separator, housing in its upper portion 30 filter bags. The lower portion, equipped with a cone hopper, serves as a primary cyclonic chamber and dust storage compartment, holding 33 cu ft of material. The bottom of the cone hopper is equipped with a quick and positive acting hinged type dust disposal valve, while the body of the dust separator is fitted with four large swing-hinged inspection doors for access to the interior.

The piping system for the vacuum cleaning installation is rather extensive, serving two foundries which are separated by a wide roadway. One foundry is 785 ft long, and the vacuum piping system serves the north 450 ft of this foundry. In the other foundry the piping system extends for approximately 200 ft, providing vacuum cleaning facilities for the south portion of the building.

Collected Dust Not Rehandled

In both foundries the piping system consists of two longitudinal mains, with laterals where required to permit drops at strategic points and at convenient levels. Each drop is capped with a vacuum inlet valve having a self-closing spring-hinged cover which automatically shuts off vacuum when the vacuum hose is removed, thus conserving power. The vacuum cleaning equipment proper is installed in the end of one foundry. The vacuum producer is indoors on a mezzanine floor, while the dust separator is mounted outdoors above a large dust storage hopper. The separator discharges directly into the storage hopper, thus eliminating rehandling of collected material.

Dust and dirt drawn into the vacuum nozzle is rapidly conveyed through the piping system to the dust separator where it is first subjected to a centrifugal separation in the lower portion of the dust separator. A high percentage of material is taken out of the air by the centrifugal action. The slight amount of dust remaining in the air is filtered out



Figs. 3 and 4—Long nozzles are used in vacuum cleaning operations on large molds for rolls and miscellaneous castings. The lance-type nozzles enable the operator to reach into the deep cavities of large molds.

as the air passes thru the inverted filter bags into the vacuum producer, to be exhausted to the atmosphere. Since the filter bags are inverted, they never fill with dust and need not be removed for cleaning. A manually operated bag shaker permits convenient shaking down of the filter bags when required.

The principal products of one of the two foundries are side frames and bolsters for railroad cars, which are turned out on a production basis, and miscella-

Fig. 5—Hand nozzles of various types are available for close-up cleaning work on small or shallow molds.

neous castings. No change was made in the cleaning station arrangement other than the substitution of vacuum cleaning in place of compressed air cleaning. The two cleaning station operators now use vacuum lines in place of compressed air lines, one during assembly of cores and one at the end for the close-up.

Work Continues During Cleaning

The improvement in working conditions around the cleaning station areas once vacuum cleaning was started was strikingly impressive. No longer was each station surrounded by a foggy cloud of dust. Molds and cores which had been vacuum cleaned remained clean until the close-up. The operators, working in a clean atmosphere with greatly improved visibility, turned out a better job with less effort.

Vacuum cleaning cores and molds for miscellaneous castings and for rolls cast in the second foundry proved equally advantageous (Figs. 3 and 4). It was no longer necessary to "clear the deck" for cleaning. Work went on without interruption during cleaning operations. Dust and dirt was completely removed where formerly it had been blown into the air to spread over the area and to settle on previously cleaned molds.

Special nozzles are used for various types of cleaning, each designed to be most effective for a specific purpose. Slender, lance-type nozzles permit the operators to reach into deep mold cavities and flush them clean. Hand nozzles of various designs permit close-up

Fig. 6—The vacuum system is also used with tools adapted for general cleaning—walls, floors, and equipment such as the electric furnace motor shown above.

work (Fig. 5). Still other tools are available for the more general types of cleaning such as walls, floors, equipment, motors, etc. (Fig. 6).

Vacuum cleaning of molds and cores has greatly reduced the occurrence of sand inclusions in casting surfaces. The improved finish obtained has decreased the amount of welding and other operations required in the casting cleaning room. Appreciable savings have also been made in reduced consumption of compressed air.

Another important gain which must be attributed to the vacuum cleaning is a marked reduction in eye injury cases. While it is not possible to gage the exact percentage, it is reasonably safe to assume that at least a 25 per cent reduction has resulted since vacuum cleaning replaced compressed air cleaning. Working conditions for the operators have been greatly improved, as have working conditions for the foundry in general. Certain health hazards have been eliminated and injuries have been appreciably reduced.

Of the many problems that face the foundry operator today, the problem of whether to clean molds by vacuum or compressed air can be classified as important or minor, depending upon the individual foundry. In the author's foundry it was recognized as an important problem, and it is believed that the installation of a modern vacuum cleaning system has brought important benefits and improvements.

NEW A.F.S. PINS AVAILABLE

New membership, 25 and 50-year foundry service pins bearing the legend "A.F.S.", replacing the now-outmoded "A.F.A." pins, are available. Service pins will be presented at the 1950 Foundry Congress. New membership pins are available at $1 each from A.F.S. Headquarters or will be exchanged for old pins.

Hold Third Ohio Regional Foundry Conference

INTEREST IN QUALITY CONTROL brought foundrymen together in Cincinnati, March 10 and 11, when the Third Ohio Regional Foundry Conference was held in the Netherland Plaza Hotel. On the two day program staged under the direction of Conference Chairman Edw. H. King, Hill & Griffith Co., and Walter Klayer, Aluminum Industries, Inc., Chairman of the Cincinnati District Chapter, were four sessions each on gray iron, non-ferrous, malleable, and steel foundry practice.

Special sessions included the closing luncheon at which National President E. W. Horlebein and Secretary-Treasurer Wm. W. Maloney spoke, the opening day luncheon, and the conference banquet which ended the first day's round of meetings.

Cooperating in the conference with the host chapter, Cincinnati District, were the other Ohio chapters of A.F.S.—Northeastern Ohio, Central Ohio, Canton District, and Toledo.

With Chairman King presiding, Mr. Klayer officially opened the conference and was followed by President Raymond Walters of the University of Cincinnati. Speaking on *"Industry's Stake in Education,"* Dr. Walters explained the predominance of the United States' industrial achievement and stressed the importance of training men to translate pure science into technology, in which, he said, the United States excels.

L. G. Mitten, Ohio State University, and Harry E. Placke, G.H.R. Foundry, Dayton, Ohio, set the theme of the conference with their keynote addresses *"Quality Control," "Tools—What They Will and Won't Do,"* and *"Quality Control in Actual Practice."* Variability in products and processes are inevitable, declared Mr. Mitten, and quality control tries to control the variability. Effective quality control reduces costs and increases product quality and service, he said, in pointing out that acceptance inspection and process control are the basic quality control tools.

President Raymond Walters, University of Cincinnati, opening the Ohio Regional Foundry Conference with an address on "Industry's Stake in Education." Seated, starting left, are: Walter Klayer, Aluminum Industries; Edw. H. King, Hill & Griffith Co.; Harry E. Placke, G. H. R. Foundry, Dayton; and L. G. Mitten, Ohio State.

L. A. Danse, General Motors Corp., Detroit, reviewing new developments at the final luncheon. Photos are by Wilfred H. White of Jackson Iron & Steel Co.

In his talk, Placke described the initiation and development of a quality control program in his plant. Quality control is a management function he explained, and told how a 25 pound capacity scale and a few benches made by the shop carpenter were the only expenditures in starting the program.

Speaker at the first day's luncheon was Fred Smith of Wm. Powell Co., Cincinnati, who spoke on *"The Art of Togetherness."* Our unique contribution to the world, mass production, said Mr. Smith, brought new problems in personnel relations, and he cited the need for management to identify itself with the interests of employees. Co-chairmen of the luncheon session were Messrs. Klayer and King.

B. P. Mulcahy, Fuel Research Laboratory Inc., Indianapolis, started the gray iron meeting with a talk entitled *"The Cupola—Its Raw Materials and Operation."* He emphasized the application of fundamentals and the proper preparation and handling of charged materials.

Bringing out the importance of selection and sizing of scrap, the speaker outlined the difficulties a foundry encountered in trying to melt unbroken motor blocks in a 42 inch cupola.

Mr. Mulcahy's talk covered every phase of raw material usage in the cupola. Presiding at the session were Sam Clow, James B. Clow & Sons, Coshocton, Ohio, and Martin Milligan, Lunkenheimer Co., Cincinnati.

Non-ferrous foundrymen heard George P. Halliwell, H. Kramer & Co., Chicago, speak on *"The Application of Some Fundamental Principles to the Melting, Pouring, and Casting of Copper-base Alloys"* at the first non-ferrous session. Hydrogen removal with oxidizing fluxes, he said, is better done on alloys with less than one per cent zinc else the zinc is preferentially oxidized and the hydrogen remains. He discussed nitrogen degasification and pre-solidification. C. F. Bunting, Pittsburgh Valve & Fitting Div., Pitcairn Corp., Barberton, Ohio, and Arthur Kuhn, Reliable Castings Co., Cincinnati, were co-chairmen.

At the first malleable iron session Milton Tilley, National

Malleable & Steel Casting Co., Cleveland, spoke on *"The Effect of Oxidation in Cupola Melting on the Annealability of Malleable Iron."* Presiding were John Manos, Lake City Malleable Co., Cleveland, and Arthur Grimm, Dayton Malleable Iron Co., Dayton.

Oxidation reduces the number of graphite nuclei, declared Mr. Tilley, and this is at least a partial answer to the reduced annealability. He showed graphs of conditions in his plant to illustrate that at 35 per cent oxidation of silicon charged (25 per cent is his normal figure) annealing time became commercially impractical. While heavy treatment with ferrosilicon may salvage over-oxidized metal, overdoing it can result in loss of fluidity, poor sulphide form, and primary graphite, the speaker warned.

Uses Oxygen in Open Hearth

L. L. Whitney, American Steel Foundries, Alliance, Ohio, opened the steel series with a description of open hearth practice in which oxygen is used as a melting agent and as a carbon remover. Benefits reported include faster melting, decreased melting cost, 75 per cent increase in waste heat boiler steam, slight decrease in refractory costs, and hotter melts. Chester B. Williams, Massillon Steel Castings Co., Massilon, Ohio, presided.

Late afternoon speakers and their topics were: Harry W. Kessler, Sorbo-Mat Process Engineers, St. Louis—*"Gating and Risering;"* L. W. Eastwood, Battelle Memorial Institute, Columbus, Ohio—*"Determination of Melt Quality of Tin Bronzes;"* Robert O. Mayer, Haven Malleable Castings Co., Cincinnati—*"Direct Air Furnace Melting;"* John Varga and Howard Bleil, Lake City Malleable Co., Cleveland—*"Zirconium in Malleable Iron;"* and Sam F. Carter, American Cast Iron Pipe Co., Birmingham, Ala.—*"Melting Practice on Hydrogen."*

Mr. Kessler outlined a system for calculating riser size based on casting weight, section to be risered, and class of iron being poured. Riser diameter should be 1½ times the casting section to be fed, with riser height twice the diameter, he said. The speaker recommended round rather than square risers. D. C. Williams, Ohio State University, and Jos. S. Schumacher, Hill & Griffith Co., Cincinnati, were co-chairmen of the session.

A quality melt, according to Dr. Eastwood, possesses a chemical composition within specifications and produces a low degree of unsoundness due to gas evolution. Tensile properties, density, fracture appearance, and leak tightness are good indications of melt quality, he declared.

Replacement of two eight ton hand fired air furnaces with a 20 ton pulverized coal fired unit was described by Mr. Mayer in the first half of a malleable iron session presided over by F. W. Dixon, Haven Malleable Castings Co. A major problem was the selection of a suitable coal required as a result of the change over. Now used is a coal purchased to BTU and ash specifications with a minimum BTU content of 15,000, said the speaker.

Zirconium Affects Cementite Solution

Reporting on research conducted at Case Institute of Technology, Varga and Bleil said that in a series of heats analyzing 0.054 to 0.329 per cent zirconium the time for complete solution of cementite at the upper critical increased directly with the zirconium. Second stage annealing seemed to be unaffected, they found.

Hydrogen absorption and retention are strongly affected by the chemistry of the steel and sequence of operations, Mr. Carter said, in discussing his work with electric arc furnace steels. Because of maximum affinity for hydrogen in the ready-to-tap condition, hydrogen pickup from improperly dried ladles and spouts apparently ruins more heats than conditions in the furnace, he stated. He recommended a vigorous boil followed by maintenance of oxidizing conditions to obtain a low hydrogen steel.

Presiding at the steel session were Harold C. Templeton, Babcock & Wilcox Co., Barberton, Ohio, and O. Brown, Dayton Steel Foundry Co., Dayton, Ohio.

"What Is Your Washroom Rating?" was the topic of E. A. McFaul, Midwest Institute, Chicago, at the conference banquet which ended the first day's sessions. He discussed practical psychology of human relations in an instructive and entertaining talk. Co-chairmen at the banquet were Mr. Klaver and Mr. King.

A breakfast attended by Ohio State University graduates now in the foundry industry initiated the second round of technical meetings on March 11. At the day's first gray iron meeting, Tom Barlow, Eastern Clay Products, Inc., Jackson, Ohio, spoke on *"Quality Castings Require Good Sand Practice."* Citing practical examples, he outlined good sand practice and warned against the tendency to forget fundamentals and to look for some cure-all to foundry sand problems. The sand phase of foundry technology is relatively undeveloped, he stated. A. W. Schneble, Advance Foundry Co., Dayton, Ohio, and Martin E. Rollman, Cincinnati Milling Machine Co., were co-chairmen.

Gordon B. Mannweiler, Eastern Malleable Iron Co., Naugatuck, Conn., reviewed the status of pearlitic malleable irons, at a session which had as co-chairmen John Manos,

A. D. Barczak, Superior Foundry, Inc., Cleveland, and part of the large audience of gray iron foundrymen who heard him discuss controls and tests for small foundries.

Lake City Malleable Co., and Robert O. Mayer, Haven Malleable Castings Co.

While manufacturing practice varies throughout the industry, said Mr. Mannweiler, the end product is similar in all cases—a microstructure of temper carbon dispersed in a pearlitic or sorbitic matrix. He described melting and heat treating practices.

Walter F. Sicha, Aluminum Company of America, Cleveland, and Walter Klayer, were co-chairmen of the early morning aluminum session at which foundrymen heard Alcoa's R. R. Senz discuss *"Control of Quality of Aluminum Alloy Castings."*

In his talk, *"Use of Exothermic Materials as Aids to Better Feeding,"* Michael Bock, Exomet, Inc., Conneaut, Ohio, traced the development of these materials from the status of an emergency casting medium during the war, to their use in promoting higher yields and sounder castings. Co-chairmen of this steel session were Leo Dirrig, Atlantic

Dickey Dyer (seated), Dyer Engineers, Inc., Cleveland, spoke on estimating and costing after F. W. Dixon's (Haven Malleable Casting Co., Cincinnati) introduction.

Foundry Co., Akron, Ohio and William Love, Lunkenheimer Co., Cincinnati.

A. D. Barczak, Superior Foundry, Inc., Cleveland, presented a comprehensive discussion on *"Controls and Tests for Quality Castings in the Smaller Foundry,"* at the final gray iron session. J. D. Judge, Hamilton Foundry & Machine Co., Hamilton, Ohio, and Stanley Levy, Keuthan Div., Black Clawson Co., Middletown, Ohio, presided.

Quality castings cannot be guaranteed without the help of chemical, mechanical, and sand laboratories, Mr. Barczak asserted. Whether these are an integral part of the foundry, he said, or commercial laboratories becomes a problem in economics. He outlined a quality control program which covered pattern preparation, core sands, molding sands, metal and the raw materials used to produce it, inspection, and scrap control.

Watch Quality Improve

Treatment of castings returned by the customer, described by the speaker, includes careful examination and recording by the chief inspector, followed by delivery to the discount room where it is examined by the foreman and production workers. Scrap then goes to the cupola for remelt. A record of all casting returns enables the foundry to determine whether progress in improving quality is being made, concluded Mr. Barczak.

How to make a single function out of estimating and costing was explained by Dickey Dyer, Dyer Engineers, Inc., Cleveland, in the last malleable session of the conference. F. W. Dixon, Haven Malleable Castings Co., presided.

Speaking on *"Consolidating Estimating and Costing Through Effective Control,"* Mr. Dyer pointed out that by combining the two operations foundrymen can make substantial savings through improved shop efficiency, and can achieve greater price accuracy.

Gating for magnesium castings of the highest quality must preserve the cleanliness of the metal in its transfer from crucible to mold cavity, and promote directional solidification, said H. E. Elliot, Dow Chemical Co., Bay City, Mich., at the closing non-ferrous session. Presiding at the meeting during which he talked on *"Effect of Gating and Risering Design on Magnesium Casting Quality"* were L. Brown, Magnesium Fabricators Div., Bohn Aluminum & Brass Corp., and Walter Klaver.

Mr. Elliot explained that gating systems must either prevent turbulent flow, or else make provision for removal of oxidation products before the metal enters the mold cavity. Notable efforts to develop such systems are being made by the A.F.S. Aluminum and Magnesium Research Committee, he declared.

"Some Fundamental Thoughts for Steel Foundry Sand Control" is the title of a provocative paper presented at the last steel session of the conference by Clifford E. Wenninger, University of Kentucky. He distinguished between an empirical and a fundamental approach to steel foundry sand control and called on his listeners to give thought to what is fundamental in sand behavior. Alexander Prentice, Stark Foundry, Canton, Ohio, and Jack Caine, consultant, Cincinnati, were session co-chairmen.

The Third Ohio Regional Foundry Conference closed with a luncheon honoring National President E. W. Horlebein and Secretary-Treasurer Wm. W. Maloney. Technical speaker was L. A. Danse, General Motors Corp., Detroit; Walter Klayer and Edw. H. King were co-chairmen.

Mr. Danse decried the lack of casting mindedness on the part of designers and cited a recent instance in which stampings instead of castings were specified even though a process for producing precision gray iron castings was fully developed for the part. He said that development of foundry equipment has not kept pace with mechanical developments in other fields and predicted that someday mold making will be fully automatic.

Helped Run Conference

Conference Chairman King was assisted in planning and organizing the conference program by the following co-chairmen: gray iron—D. E. Krause, Gray Iron Research Institute, Columbus, and D. C. Williams, Ohio State University; steel—George M. Biggert, United Engineering & Foundry Co., Canton; non-ferrous—Harry G. Schwab, Bunting Brass & Bronze Co., Toledo; malleable—S. E. Kelly, Eberhard Mfg. Co., and Fred J. Pfarr, Lake City Malleable Co., Cleveland. Wm. Oberhelman, Oberhelman-Ritter Foundry Co., and Jos. S. Schumacher, Hill & Griffith Co., were in charge of registration. Burt A. Genthe, S. Obermayer Co., handled publicity; printing and arrangements were directed by Thomas H. Erhart, Chris Erhart Foundry & Machine Co. Martin E. Rollman, Cincinnati Milling Co., was Speaker and Conference Committee chairman. Treasurer for this year's Ohio Regional Foundry Conference was Charles Dold, Portsmouth Steel Co., Cincinnati.

The conference just ended is the third sponsored by the five chapters of A.F.S. in Ohio. The series started in 1948 when the first was held in Cleveland. Last year the Central Ohio Chapter (Columbus) was host.

Geo. P. Halliwell, H. Kramer & Co., explaining partial pressure effect in degasification of copper-base alloys.

New AFS MEMBERS

NEW COMPANY MEMBERS

Fire Brick Service & Supply Co., Toledo, Ohio—W. A. Cowger, Mgr. (Toledo Chapter).

Martin Engineering Co., Kewanee, Ill.—Edwin F. Peterson, Pres. (Quad City Chapter).

Vancouver Engineering Works Ltd., Vancouver, B. C., Canada—A. J. Peck, Plant Supt. (British Columbia Chapter).

BIRMINGHAM CHAPTER

Byron E. Kennel, Student, University of Alabama, University, Ala.
Nathan Russell Koenig, Student, University of Alabama, University, Ala.
Anthony J. McAndrews, Student, University of Alabama, University, Ala.
Dwight E. McGill, Student, University of Alabama, University, Ala.
A. A. Ringland, Jr., Jackson Industries, Inc., Birmingham, Ala.

BRITISH COLUMBIA CHAPTER

Vancouver Engineering Works Ltd., Vancouver, B. C., Canada—(A. J. Peck, Plant Supt.).

CANTON DISTRICT CHAPTER

Clyde B. Shetler, Fmn., United Engineering & Foundry Co., Canton, Ohio.

CENTRAL INDIANA CHAPTER

Harry Hosier, Fmn., Hoosier Iron Works, Kokomo, Ind.
William H. Faust, Melting Dept., Electric Steel Castings Co., Indianapolis.
John A. Thomas, Dept. Head, Perfect Circle Corp., New Castle, Ind.

CENTRAL MICHIGAN CHAPTER

Robert Cain, Engineering Castings, Inc., Marshall, Mich.
John T. Ehman, Albion Malleable Iron Co., Albion, Mich.
Sven Hybinette, Hybinette Laboratory, Jackson, Mich.
Patrick M. Settanni, Albion Malleable Iron Co., Albion, Mich.
Robert L. Stephenson, Met. Engr., A. F. Holden Co., Lansing, Mich.

CHESAPEAKE CHAPTER

Thomas A. Bessent, Prod. Engr., Bethlehem Steel Co., Sparrows Point, Md.
Albert G. Fritz, Asst. Gen. Fmn., Bethlehem Steel Co., Sparrows Point, Md.
John H. Williams, Fdy. Fmn., 579th Foundry Detachment, Fort Belvoir, Va.

CHICAGO CHAPTER

Fred E. Crone, Fdy. Supt., Thor Corporation, Cicero, Ill.
Carl K. Evans, Fmn., Continental Foundry & Machine Co., East Chicago, Indiana.
Stanley B. Lasday, Asst. Met., Association of Manufacturers of Chilled Car Wheels, Chicago.

CINCINNATI CHAPTER

H. B. Boecker, Asst. to Fdy. Mgr., Minster Machine Co., Minster, Ohio.
Vincent J. Judacko, Student, University of Cincinnati, Cincinnati, Ohio.

DETROIT CHAPTER

Steve Bradshaw, Fmn., Pontiac Motor Div., General Motors Corp., Pontiac, Michigan.
Robert H. Christenson, Trainee, Pontiac Motor Div., General Motors Corp., Pontiac, Mich.
Anthony William Dobrovich, Lab. Asst., The Detroit Testing Laboratory, Detroit.
Thomas J. Donnelly, Supv., Cadillac Motor Car Div., General Motors Corp., Detroit.
Neil C. Dostal, Plt. Mgr., Dostal Foundry & Machine Co., Pontiac, Mich.
Henry Warren Jones, Detroit Mgr., Swan Finch Oil Corp., Detroit.
E. J. Morisette, Chrysler Corp., Detroit.
Vernon H. Patterson, Met. Engr., Climax Molybdenum Co., Detroit.
Frank V. Righettini, Supv., Cadillac Motor Car Div., General Motors Corp., Detroit.
Walter W. Ring, Fdy. Sand Tech. & Part Time Student, Cadillac Motor Car Div., General Motors Corp., Detroit.
Peter Rock, Gen. Fmn., Ford Motor Co., Detroit.
Kenneth W. Smerly, Supv., Cadillac Motor Car Div., General Motors Corp., Detroit.
Nelson White, Fmn., Packard Motor Car Co., Detroit, Mich.
William F. Winemiller, Refractories Engr., Norton Co., Birmingham, Mich.

EASTERN CANADA CHAPTER

Nova Scotia Technical College Library (Prof. Baker), Halifax, N. S., Canada.

EASTERN NEW YORK CHAPTER

Edmond S. Bauer, Asst. Sales Mgr., Plastics Div., Monsanto Chemical Co., Springfield, Mass.
Leslie Swales Wilcoxson, Jr., Student, Rensselaer Polytechnic Institute, Troy, N. Y.

METROPOLITAN CHAPTER

Joseph Spindler, Partner, Spindler Brothers, Kenilworth, N. J.
Robert C. Straka, Jr. Sales Engr., Harbison Walker Refractories Co., New York.
Paul L. Wood, II, Appr., Eastern Malleable Iron Co., Naugatuck, Conn.

MICHIANA CHAPTER

Lyle Hughes, Supt. of Fdy., Torrington Co., Bantam Bearings Div., South Bend, Ind.

NORTHEASTERN OHIO CHAPTER

Fred Karpoff, Jr., Student, Case Institute of Technology, Cleveland.
Willard R. Hohl, Met., W. O. Larson Foundry Co., Grafton, Ohio.
Robert F. Maloney, Jr., Sales Engr., Kerchner, Marshall & Co., Pittsburgh.
Elliott H. Morris, Student, Case Institute of Technology, Cleveland.
Forrest R. Old, Asst. Dist. Mgr., Peninsular Grinding Wheel Sales Corp., Cleveland.

NORTHERN CALIFORNIA CHAPTER

Elgo Sabatini, Asst. Gen. Mgr., General Metals Corp., Oakland, Calif.

NORTHERN ILLINOIS & SOUTHERN WISCONSIN CHAPTER

Paul Lemot, Secy.-Treas., Lemot Iron & Metal Co., Inc., Beloit, Wis.

NORTHWESTERN PENNSYLVANIA CHAPTER

William J. Willmot, Fdy. Engr., Cooper Bessemer Corp., Grove City, Pa.

ONTARIO CHAPTER

George Bott, Fdy. Supt., Welland Electric Steel Foundry, Welland, Ont., Canada.
Arthur Flavell, Fmn., International Harvester Co., Hamilton, Ont., Canada.
Frank Freeman, Master Mechanic, The Gurney Foundry Co. Ltd., Toronto, Ont., Canada.
R. Hepburn, Gen. Mgr., Soil Pipe & Fittings Ltd., Mimico, Ont., Canada.
Alex Pirrie, Plt. Mgr., The Gurney Foundry Co. Ltd., Toronto, Ont., Canada.
Gerrit H. Pool, Salesman, Semet Solvay Co. Ltd., Toronto, Ont., Canada.
H. S. Powell, Fmn., The Gurney Foundry Co. Ltd., Toronto, Ont., Canada.
Norman Sims, Fmn. Pattn. Shop, The Steel Co. of Canada Ltd., Hamilton, Ont., Canada.

OREGON CHAPTER

Del Wise, Sales Mgr., Morris P. Kirk & Son, Inc., Portland, Ore.

PHILADELPHIA CHAPTER

William Brown Alexander, Tech. Repr., Bakelite Div. of Union Carbide & Carbon Corp., Philadelphia.

QUAD CITY CHAPTER

Martin Engineering Co., Kewanee, Ill.—(Edwin F. Peterson, Pres.).
Webster Keith Mason, Supv., of Rates & Methods Dept., J. I. Case Co., Bettendorf, Iowa.
Fred J. Schulz, Fmn., Palmer Bee Unit, J. I. Case Co., Bettendorf, Iowa.

ST. LOUIS CHAPTER

George W. Apel, Area Supv., Bureau of Apprenticeship, U. S. Dept. of Labor, St. Louis.
Carl S. Edwards, Master Mechanic, U. S. Radiator Corp., Edwardsville, Ill.

Malleable Founders' Society Holds Two-Day Marketing Conference

At the speakers' table during the dinner climaxing the MFS Marketing Conference at Northwestern University, March 22-23, were, left to right: Ralph T. Rycroft, Sr., Kencroft Malleable Co., Buffalo, N. Y., MFS vice-president; W. J. MacNeill, Dayton Malleable Iron Co., Dayton, Ohio, chairman, MFS Market Development Committee, and a director of A.F.S.; Eugene Mapel, Methods Engineering Council, Pittsburgh, principal speaker; Jas. H. Smith, Central Foundry Div., GMC, Saginaw, Mich., president of Malleable Founders' Society; Cal C. Chambers, Texas Foundries, Inc., Lufkin, Tex.; Roy C. Hobson, National Malleable & Steel Castings Co., Cleveland; Lowell D. Ryan, managing director, Malleable Founders' Society; and D. L. Boyes, Central Foundry Div., GMC.

Vernon E. Lich, Asst. Mech. Supt., General Steel Castings Corp., Granite City, Ill.
Charles D. Lutz, Pres., C. D. Lutz & Sons Sand Co., Mulhenv Grove, Ill.
John Mauterer, Fdy. Supt., Enterprise Foundry, Belleville, Ill.
Luis Mojicar, Appr., Pattern Makers Joint Apprenticeship Committee, St. Louis.
Milton Rosenberg, Fdy. Prod. Mgr., Enterprise Foundry, Belleville, Ill.
Otto Shelton, Fdy. Fmn., General Steel Castings Corp., Granite City, Ill.
Douglas K. Sullivan, Fmn., Sand System, General Steel Castings Corp., Granite City, Ill.
Rumsey G. Thompson, Mfg. Agent, Laclede Christy Co., St. Louis.

TENNESSEE CHAPTER

Hugh C. Dance, Trainee, The Wheland Co., Chattanooga, Tenn.
John W. Goodwyn, Southeastern Sales Repr., U. S. Graphite Co., Chattanooga, Tenn.

TEXAS CHAPTER

Walter L. Alexander, Dir. of Master Scheduling, Hughes Tool Co., Houston, Texas.

TOLEDO CHAPTER

Ellery Cherry, Service Engr., Master Pneumatic Tool Co., Orivell, Ohio.
Fire Brick Service & Supply Co., Toledo, Ohio—(W. A. Cowger, Mgr., Toledo Office).

TRI-STATE CHAPTER

J. Homer Garrison, Met., Oklahoma Steel Castings Co., Tulsa, Okla.
Jean C. Roark, Met., Arrow Laboratory, Wichita, Kansas.

WESTERN MICHIGAN CHAPTER

Robert W. Grace, Sales Repr., Cleveland Tramrail Muskegon Co., Muskegon Heights, Mich.
Vernon W. Hertz, Fmn., Mold Machine Repair, Lakey Fdy. & Mach. Co., Muskegon, Mich.
Leon C. Horstman, Time Study Engr., Lakey Foundry & Machine Co., Muskegon, Mich.
Herman Murtomen, Master Mechanic, Lakey Foundry & Machine Co., Muskegon, Mich.
Edwin Olson, Fdy. Supt., Dake Engine Co., Grand Haven, Mich.
Howard Sutton, Maint. Supt., Lakey Foundry & Machine Co., Muskegon, Mich.

WISCONSIN CHAPTER

John R. Bach, Fdy. Res. Engr., Falk Corp., Milwaukee.
John L. Brandt, Sales, Swan Finch Oil Corp., Milwaukee.
Walter W. Eichenberger, Sales & Service Repr., Milwaukee Foundry Equipment Co., Milwaukee.
Leo McAvoy, Berlin Chapman Co., Berlin, Wis.
Stephen Moy Toy, Student, University of Wisconsin, Madison, Wis.

STUDENT CHAPTERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Richard D'Amato — Mariano A. Romaguera
Robert James Mellyn

MICHIGAN STATE COLLEGE

Harry J. Fik — William Richard Neale
William J. Sullivan

MISSOURI SCHOOL OF MINES

Frank J. Boscia — Burton James Duchek
Gedale David Davis

OREGON STATE COLLEGE

Don Ray Richardson

UNIVERSITY OF ILLINOIS

James B. Hatch — Edward J. Zahumensky
Nels G. Ohlson

UNIVERSITY OF MINNESOTA

Ahti O. Tuohino

OUTSIDE OF CHAPTER

Charles S. Parker, Fdy. Mgr., Charles Parker Co., Meriden, Conn.

INTERNATIONAL

Austria

Lothar Kotschy, Prod. Mgr., M. Schmid & Soehn, Gochlashruck N.O.E., Austria.

Denmark

R. Friis, Mech. Engr., Cement-Jern Konsortiet, Copenhagen, Denmark.

Italy

Dott. Ing. Palmucci Alfredo, Dottore Ingegnere Metallurgic & Foundry Compagnia Italiana Westinghouse, Torino, Italy.

Letters to the Editor

All letters of broad interest which do not violate A.F.S. policy or good taste are publishable. Write to The Editor, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Letters must be signed but will be published anonymously on specific request.

Standard Fluidity Spiral

In connection with the correspondence on fluidity in The Round Table, page 63 of your February issue, you may be interested to hear that we have been studying the fluidity of steel on behalf of the British Iron and Steel Research Association at Sheffield University for some time.

We have found that reproducible results are obtainable, provided the speed of pouring the spiral molds is closely controlled, and when due precautions have been taken to ensure that the temperature at which the molds are poured is accurately determined.

Using the spiral developed by Taylor, Rominski, and Briggs, and controlling the above factors closely, we have obtained curves showing remarkably little scatter.

We would like to put forward a plea that the type of spiral used be standardized. Many spirals of varying dimensions are at present in general use, and we feel it would be easier to correlate spiral lengths with practice, if all results referred to the same standard spiral.

J. E. Worthington
H. T. Protheroe
Sheffield University
Sheffield, England

Inoculants, Deoxidizers, Pinholes

The paper "*Basic Principles Common to Foundry Melting Practices*" by P. C. Rosenthal (American Foundryman, January, 1950, page 48) discusses a subject that is both timely and interesting.

There are, however, one or two details in Professor Rosenthal's presentation that might bear discussion. Starting at the bottom of page 49 Prof. Rosenthal discusses inoculants and deoxidizers and suggests that carbon diffusion or graphitizing rate as affected by oxygen content may account for the influence of an inoculating agent.

The manner in which inoculants operate in affecting the structure and resulting properties of cast iron is widely discussed but not well understood. I do not know what the mechanism or action of inoculants is, but I am reasonably sure that it is not merely an effect on a change in diffusion rates of carbon as affected by oxygen content. The diffusion rate of carbon in iron is much too rapid to account for observed graphitizing rates in normal iron—some intermediate mechanism must be operating.

With respect to residual aluminum and the statements concerning residual aluminum in cast steel, it is considered that the subject of the effect of aluminum residuals is open since work at present underway in these laboratories indicates that there is considerable yet to be learned.

In discussing gas removal Prof. Rosenthal points out that an oxidizing condition will keep hydrogen to a minimum whereas a metal kept in a reduced condition by, say, aluminum, would have a good chance to absorb hydrogen. It is suggested that this may account for the porosity in gray iron containing excessive amounts of aluminum. I do not know whether hydrogen is the active agent in producing the well-known porosity accompanying appreciable amounts of aluminum in gray iron but I think there is a more fundamental explanation.

This is that when aluminum is present a thin tenacious film of aluminum oxide forms instantly on the surface of the molten iron. When the metal is poured, any gases present in the liquid iron which would tend to escape during solidification are trapped by the impermeable film of aluminum oxide. When gray iron contains more than one or two hundredths of a per cent of aluminum this surface film or rather its effects can be readily seen on the liquid iron, the metal pouring and running sluggishly and with a characteristic surface appearance.

In this connection, the pinholing encountered in some nodular iron castings may be due to a surface film of magnesium oxide or silicate that prevents escape of metal gases in the mold.

J. E. Rehder, *Fdry. Engr.*
Canadian Bureau of Mines
Ottawa, Ontario

For more on pinholes see The Round Table, page 134.

Too Few Foundry Recruiters

It is good that F. G. Sefing, International Nickel Co., (*"Personnel Plans Made Now Assure Industry Growth,"* American Foundryman, January, 1950, page 21) and some others continue to hammer away on the need of training in the foundry industry. Enormous progress has been made in the past 20 years, and I doubt if any other industry has anything to compare with the Foundry Educational Foundation. However, the fact still remains that we in the colleges see practically no recruiting officials from the foundry industry, although other important industries continue to be exceedingly well represented in our corridors and conference rooms from January until about the middle of May.

C. J. Freund, *Dean*
College of Engineering
University of Detroit

Show Castings in Industrial Exhibit

This exhibit of the Great Lakes Manufacturing and Foundry Co., Wyandotte, Mich., makers of alloy iron and gray iron production and jobbing castings, was a feature of the recent Michigan Downriver Industrial Empire Exhibit held at Trenton, Michigan. Displayed on the booth were castings weighing from 4 oz to 6,000 lb, mostly cast from matchplate production equipment.

WHO'S WHO

J. W. Gaffney

James W. Gaffney, author of *"Economy Plus from Vacuum Cleaning in Foundries,"* Page 141, is master mechanic for the Ohio Steel Foundry Co., Lima, Ohio . . . Since serving his apprenticeship with the Baltimore & Ohio Railroad at Ivorydale, Ohio, Mr. Gaffney has been employed in mechanical positions with the Truimp Electric Co. and R. K. LeBlond Co., Bickford Machine Tool Co., Williamson Heater Co., and the Cincinnati Milling Machine Co., all of Cincinnati.

R. A. Colton

R. A. Colton, co-author with R. H. Gilbert of *"Optimum Additions in Commercial Yellow Brass,"* Page 135, graduated with a B.S. Metallurgy from Carnegie Institute of Technology, and held his first position as research assistant there and his second in the same capacity at Stevens Institute of Technology . . . After spending three years conducting research on copper base alloys for the Naval Research Laboratory during World War II, Mr. Colton joined Federated Metals Div., American Smelting & Refining Co. in 1946. . . . He is today in charge of research development of copper base casting alloys for Federated, traveling throughout the country aiding foundries in the solution of engineering problems.

R. H. Gilbert

Robert H. Gilbert, co-author of *"Optimum Aluminum Additions in Commercial Yellow Brass,"* Page 135, is research metallurgist for the American Smelting & Refining Co., Ocean Grove, N. J. . . . A graduate of the Philadelphia College of Pharmacy & Science in 1936, Mr. Gilbert served as chemist for the Rundle Mfg. Co., Camden, N. J. from 1936 to 1942, and as chief metallurgist for the General Bronze Corp., New York, prior to accepting his present position . . . Now investigating foundry applications of copper-base alloys at American Smelting & Refining, Mr. Gilbert is concurrently taking a graduate course in metallurgy at the Stevens Institute of Technology.

W. H. Johnson

William H. Johnson, co-author with William O. Baker and William S. Pellini of *"Principles of Gating Design,"* Page 107, has been metallurgist with the U. S. Naval Research Laboratory, Washington, D. C., since 1943 . . . A graduate of Lafayette College, with a B.S. in Metallurgical Engineering, Mr. Johnson has appeared before local, regional and national meetings of A.F.S. and has written for the technical press . . . He is a member of A.F.S., ASM and AIME.

W. O. Baker

William O. Baker, co-author of *"Principles of Gating Design,"* Page 107, like his collaborators is a member of the staff of the U. S. Naval Research Laboratory, Washington, D. C., where he is laboratory mechanic . . . Mr. Baker, who attended the University of Illinois, has written for the technical press and for A.F.S. publications in recent years.

W. S. Pellini

William S. Pellini, like his co-authors, William H. Johnson and William O. Baker, is employed by the U. S. Naval Research Laboratory, Washington, D. C., where he is head of the Metal Processing Branch of the Metallurgy Division . . . A graduate of the Carnegie Institute of Technology, Mr. Pellini began his career as a staff member of that institution's Metals Research Laboratory in 1940 . . . During World War II he headed a research unit for the Armor and Projectile Laboratory at the Naval Proving Ground, and later was senior metallurgist for the American Brake Shoe Co.'s Mahwah, N. J., Foundry Research Laboratory . . . Mr. Pellini joined the Naval Research Laboratory in 1948, following two years spent as senior metallurgist with the Oak Ridge National Laboratory, Oak Ridge, Tenn. Awarded the national prize for a university research thesis in metallurgy, presented by AIMME in 1940, Mr. Pellini has since maintained his high standard of technical writing with articles in metals society journals and papers presented before technical societies.

C. T. Hassell

Charles T. Hassell, author of *"Wage Incentive Administration,"* Page 127, is manager of Industrial Engineering, Lester B. Knight & Associates, Inc., Chicago . . . A graduate of the Carnegie Institute of Technology, Mr. Hassell began his career as a foundryman with Bessemer Gas Engine Co., Grove City, Pa., where he was employed in all foundry departments of the company . . . He has been engaged in the industrial engineering profession since 1928, when he joined Stevenson, Jordan & Harrison, Inc. . . . Since that time Mr. Hassell has served as advisor to many foundries in the development and installation of wage incentive systems, cost systems and budgetary controls.

Marshall Petty

Marshall Petty, co-author of *"Refractory Practice in Acid Electric Steel Melting,"* Page 117, is melter foreman for the Key Co., East St. Louis, Ill. . . . Mr. Petty has been an employee of the Moffat Coal Co., Sparta, Ill.; and the Alton & Southern Railroad prior to joining the Key Company in 1938. . . . He is co-author of a paper on the use of the oxygen electric steel furnace, given at the 1948 meeting of the Electric Furnace Section of AIME.

R. H. Jacoby

Robert H. Jacoby, co-author with Marshall Petty of *"Refractory Practice in Acid Electric Steel Melting,"* Page 117, is chief metallurgist for the Key Co., East St. Louis, Ill. . . . Chairman of the A.F.S. Sand Shop Practice Course Committee and a member of the Sand Properties at Elevated Temperatures Committee, Mr. Jacoby's career includes executive metallurgical positions in several foundries in St. Louis.

Samuel Lipson

Samuel Lipson, co-author with Hyman Rosenthal of *"Precision Casting Aluminum In Moist Investment Molds,"* Page 122, has been metallurgist at Frankford Arsenal, Philadelphia, since 1940 . . . Mr. Lipson, who attended Temple University, is a member of ASM and has written articles on precision investment casting for metals societies' journals and for the metals trade press.

H. Rosenthal

Hyman Rosenthal, co-author of *"Precision Casting Aluminum in Moist Investment Molds,"* Page 122, like his collaborator, Samuel Lipson, is metallurgist for Frankford Arsenal, Philadelphia . . . A graduate of Yale University with a B. Eng. in 1939, Mr. Rosenthal was appointed metallurgist at Frankford that year . . . A member of AIME and ASM, he has written several articles for technical publications.

S. F. Krzeszewski

S. F. Krzeszewski, author of *"Selection and Application of Cleaning Room Equipment,"* Page 96, is works manager for the American Wheelabrator & Equipment Corp., Mishawaka, Ind. . . . A veteran of many years' experience in the foundry industry, Mr. Krzeszewski's background includes three years as a foreman, six years as superintendent of assemblies and forges, seven years as factory superintendent, four years as general superintendent and eight years as plant manager prior to his present affiliation . . . M. Krzeszewski's technical education was acquired through study of extension courses in such subjects as engineering, industrial management and administration, foundry practice, accounting and industrial relations.

H. J. Chamberland

H. J. Chamberland, author of *"Modern Foundry Methods,"* Page 102, is research engineer for the DoALL Co., Des Plaines, Ill. . . . Mr. Chamberland, who became an apprenticed tool engineer in 1902 shortly after graduation from business college, has been in the toolmaking business for many years, including several years spent in business for himself as head of an experimental shop and as a consulting production engineer . . . Mr. Chamberland is the author of more than 300 articles on production appearing in some 38 publications, of a series of 30 "Training for War" articles in *Popular Mechanics* Magazine, and of DoALL Co.'s *"Contour Saws,"* now in its 11th Edition.

Perfect Circle Corp. Presents Molding Machine To Purdue University

A recent gift to the Mechanical Engineering Department of Purdue University was this jolt stripper molding machine for making piston rings in green sand stock molds. Shown viewing the machine on the production line of Perfect Circle Corp., New Castle, Ind., donor of the machine, are left to right: R. H. Bancroft, Perfect Circle Corp.; Prof. C. T. Marek, Purdue; Marvel Tarr, Perfect Circle; Prof. R. W. Lindley, L. D. Weast and Prof. H. A. Bolz, all of Purdue University, and D. F. Lunsford of Perfect Circle Corporation.

Visitors at the February meeting of the Missouri School of Mines Student Chapter included, back row, left to right: Marshall Petty, Key Co.; Russell Hard, M. W. Warren Coke Co.; A. L. Hunt, National Bearing Div., American Brake Shoe Co.; A.F.S. National Director L. C. Farquhar, Sr., American Steel Foundries; J. Swakalus, American Manganese Steel Div., American Brake Shoe Co. Front row, left to right: J. Howery and Speaker Lee H. DeWald, National Cylinder Gas Co.; J. H. Williamson, M. A. Bell Co.; C. Kenyon, Lewin Mathes Co.; and D. S. Eppelsheimer and A. W. Schlechten of the MSM Metallurgical faculty.

CHAPTER ACTIVITIES NEWS

St. Louis District

Norman L. Peukert
Carondelet Foundry Co.
Chapter Reporter

MAINTENANCE was the subject of the February 9 meeting, held at the York Hotel, with 110 attending. The meeting featured a maintenance forum panel, with F. L. Zinser, American Steel Foundries, presiding, and three main speakers.

First forum speaker was John Reichert of Scullin Steel Co., who presented a paper written by the late John W. Buck of Scullin Steel Co. on *"Maintenance in the Steel Foundry."* Mr. Reichert's talk dealt mainly with molding machines—describing their installation and operation. In closing, Mr. Reichert described the installation and maintenance of shakeouts.

W. C. Pickles, National Bearing Div., American Brake Shoe Co., was the second forum speaker. Discussing *"Non-Ferrous Furnace Maintenance,"* Mr. Pickles cited the importance of refractory and burner maintenance and described furnace maintenance practices at National Bearing.

Third and last speaker of the forum was L. C. Farquhar, Jr., East St. Louis Castings Co., who outlined a maintenance program inaugurated several years ago in his company's plant. Mr. Farquhar stressed the importance of preventive maintenance in relieving costly shutdowns in a mechanized gray iron foundry.

March 9 meeting had as its guests members of the A.F.S. Missouri School of Mines Student Chapter and Dean Curtis Wilson, who thanked the St. Louis District Chapter for its help in establishing the Student Chapter and in furnishing equipment for the school's foundry laboratory. Other guests at the meeting were entrants in the St. Louis District Chapter's Apprentice Contest, who were introduced by F. W. Burgdorfer, Missouri Pattern Works.

Dean Curtis Wilson of Missouri School of Mines addressing the St. Louis District Chapter's March 9 meeting. Thoughtful looking gentleman at Dean Wilson's left is A. F. S. President E. W. Horlebein.

Speaker of the evening was Frank G. Steinebach, Penton Publishing Co., Cleveland, who spoke on *"What Does the Foundry Industry Need?"* Mr. Steinebach cited the need for more apprentices and college-trained personnel in the industry, and for cooperation between foundries and foundry technical trade groups in furthering the interests of the foundry industry.

Eastern Canada

A. J. Moore
Montreal Bronze, Ltd.
Publicity Chairman

QUIZ NIGHT, held February 10 at the Mount Royal Hotel, was one of the best attended meetings of the season. Morris McQuiggan, Canadian Foundry Supplies & Equipment, Ltd., was quizmaster for the session. The panel of experts was made up of C. H. Poirie, Montreal Technical School; S. L. Gertsman, Canadian Bureau of Mines; E. Murphy, Canadian Car & Foundry, Ltd.; J. Hunt, Dominion Engineering, Ltd.; James G. Dick, Canadian Bronze Co., Ltd.; and Henri Louette, Warden King, Ltd.

Judges for the Quiz were E. Wins-

borrow of Shawiningan Foundries, Ltd.; and J. Grieve, Dominion Engineering, Ltd.

Quiz Night proved one of the most popular of the Chapter's recent meetings and will be continued in future.

All members of Eastern Canada, Ontario and British Columbia Chapters are reminded that there will be a Canadian Get-To-Gether during the 54th A.F.S. Foundry Congress & Show the evening of May 9 at the Hotel Statler, Cleveland. Tickets will be available at A.F.S. registration booth.

Philadelphia

Albert J. Saute
Publicity Chairman

MARCH MEETING, held at the Franklin Institute, Philadelphia, and attended by more than 300 members and guests, featured a talk and showing of newsreel films by one of America's first newsreel cameramen, J. B. White. Mr. White exhibited historic news films dating back to the first newsreel in 1894. Among those shown were President McKinley's inaugural parade, the first bathing beauty contest, "Gay Nineties" shots, Teddy Roosevelt and his Rough Riders returning from the Spanish-American War, and many other newsworthy events of the last 50 years.

Central New York

John A. Feola
Crouse-Hinds Co.
Publicity Chairman

PRINCIPAL SPEAKER at the March 10 meeting, held in the Roof Garden of the Onondaga Hotel, Syracuse, was W. C. Rudd, Induction Heating Corp., Brooklyn, who spoke on *"Dielectric Baking of Cores,"* covering problems encountered in development of the

Talking over secretarial work at the February meeting of Tri-State Chapter were, left, A.F.S. National Secretary-Treasurer Wm. W. Maloney and Tri-State Chapter Secretary Dan A. Mitchell, Progressive Brass Mfg. Co.

Snapped while deep in an informal post-dinner round table session were these Chesapeake Chapter members attending the February meet, Baltimore.

Panel members and quizmaster for Eastern Canada Chapter's Quiz Night, held February 10 at the Mount Royal Hotel, Montreal, were, front row left to right: C. H. Poirie, Montreal Technical School; S. L. Gertsman, Canadian Bureau of Mines; Quizmaster Morris McQuiggan, Canadian Foundry Supplies & Equipment, Ltd.; E. Murphy, Canadian Car & Foundry Co., Ltd.; and Henri Louette, Warden King, Ltd. Back row, left to right: John Hunt Dominion Engineering, Ltd.; and James G. Dick of Canadian Bronze Company, Ltd.

Snapped between sessions at Metropolitan Chapter's March 6 meeting were (left) Chapter Chairman C. L. Lane, Florence Pipe Foundry & Machine Co., and A.F.S. National Director Thomas E. Eagan, Cooper-Bessemer Corp. (Photo courtesy John Bing, Metropolitan Refractories Corp., New York)

process and the research work needed to develop thermo-setting resin binders used in the process.

The speaker described equipment for curing cores in minutes instead of hours. He also stated that all the properties obtained in conventionally cured cores could be duplicated by the dielectric method, however, cores of varying heights and those needing nails or chills required special attention, the speaker said.

Following his talk, Mr. Rudd showed a series of slide pictures covering various installations by his company. These pictures clearly showed the equipment, methods of handling and the variety of work that can be handled by this method.

Chapter Chairman J. F. Livingston presided and after announcing the program for the balance of the year, introduced Dr. F. R. Morral, Syracuse University, who invited foundrymen to a series of talks on various methods for testing metals that are to be held at the school on successive Wednesdays.

Northwestern Pennsylvania

Earl M. Strick
Erie Malleable Iron Co.
Chapter Secretary

TWO INTERESTING MEETINGS were held in February—the first at Oil City, Pa., February 17, with A.F.S. National Director T. E. Eagan, Cooper Bessemer Corp., Grove City, Pa., speaking on "*Nodular Iron*," and the second held at the Moose Club, Erie, February 27 with W. B. McFerrin, Electro Metallurgical Div., Union Carbide & Carbon Corp., Detroit, as speaker.

Mr. Eagan stated that iron of proper analysis and under strict control can be converted to nodular iron and properties heretofor deemed impossible can be achieved in the cast iron field. Chester Hahn, National Transit and Pump Machinery Co., Oil City, was chairman.

Mr. McFerrin spoke at the February 27 meeting on casting defects and how they should be treated in iron and steel foundries, using slides to illustrate various defects and showing charts on control and causes. Mr. McFerrin stated that accurately kept charts can be of great help to the foundry and that if remedies are not recorded, the same conditions arise time after time, causing loss of time and effort and increased scrap loss.

A movie entitled, "*Men & Molds*," was shown to the group and was well received. The chapter was honored to have as its guest, John M. Mullen, National Erie Co., vice-president of the Steel Founders Society of America, and member of the executive committee of the American Gear Manufacturers' Association.

Roger Griswold, Erie Malleable Iron Co., chairman of the educational committee of the chapter was appointed by Chairman Shuffstall to confer with the supervisors of the Veterans School in Erie with regard to establishing a foundry class in that school in the near future.

Central Indiana

William K. Mitchell
L. W. & W. K. Mitchell
Chapter Reporter

DEMONSTRATION and talk, "*Progress in Motion Study and Better Methods*," was presented by E. E. Braun, Central Foundry Div., General Motors Corp., Danville, Ill., at the Chapter's March 6 meeting.

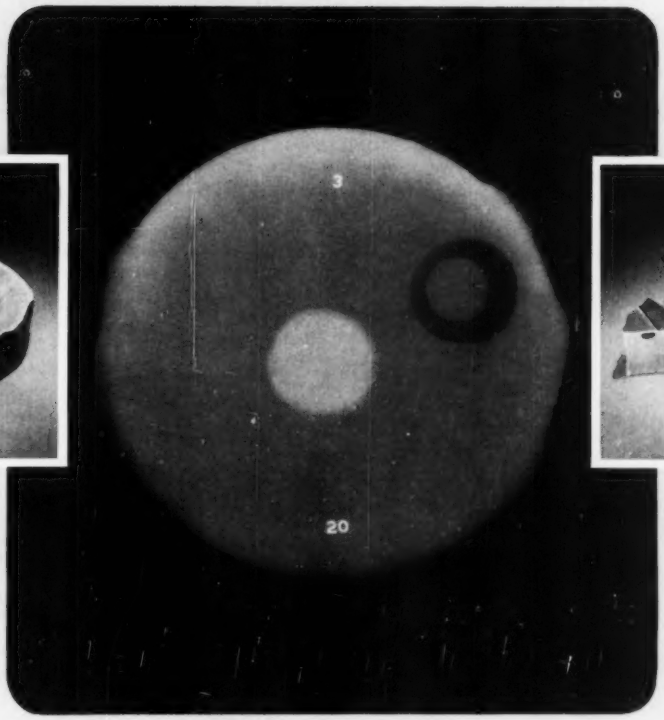
Speaking before the largest group to attend a meeting this season, Mr. Braun was assisted by S. D. Martin of Central Foundry Div.

The demonstration, which was followed by a film, described the fatigue reduction and production speed-up made possible as a result of simple motion studies. Mr. Braun described motion study as "a way of providing an arrangement of tools and materials for most effective use."

Mr. Martin, who made the demonstration while Mr. Braun spoke, contrasted old and new methods of filing,

Talking foundry shop at the March 10 meeting of Southern California Chapter were (left) Glenn V. Ballard, Federated Metals Division, American Smelting & Refining Co., and Speaker R. A. Quadt, Hunter-Douglas Corp.

Aluminum alloy casting 2¼ x 1¼" for aircraft accessory part.



Radiograph which revealed defect in casting.

Section reveals hole detected by radiography.

Minutes of Radiography saved hours of machining

AFTER machining, this aluminum alloy casting was to be an important part in an aircraft accessory, vital to high-altitude flying. The finished part was needed quickly by the customer. Design specifications demanded high quality.

This was no time to wait for machining to disclose any defects. There was too much to lose —setup time, machining time, take-down time, as well as the reputation of the foundry.

Radiography saved all that. In a few minutes it revealed a defect that caused rejection of the rough casting at the foundry. Other castings, proved sound by radiography, were sent to the customer.

Cases like this show how more and more foundries are able to release only sound castings. Perhaps even more important, radiography is showing how to make consistently sound castings, by picturing the internal effects of changes in gating, venting, chilling, pouring temperature, and other variables.

Ask your x-ray dealer to explain how radiography can help you increase yield and cut costs.

EASTMAN KODAK COMPANY
X-Ray Division, Rochester 4, New York

Radiography . . .

another important function of photography

Kodak
TRADE-MARK

dipping and ramming cores: He was timed in each instance by a member of the audience to emphasize time saved by new methods. Mr. Martin also presented a running commentary on the film which followed, showing new methods vs. old methods used at GMC's Saginaw Malleable plant.

A question and answer session ended the meeting, which was preceded by a dinner and Directors' meeting.

Southern California

W. G. Stenberg
U. S. Electrical Motors
Publicity Chairman

LOCAL CHAPTERS of the American Society for Metals and the American Foundrymen's Society were co-sponsors of the February 10 monthly meeting

Dr. Douglas C. Williams of Ohio State University speaking at the February meeting of the Central Ohio Chapter on "Sand." (Photo courtesy Wilfred H. White, Jackson Iron & Steel Co., Jackson.)

at the Rodger Young Auditorium. A large number of members from both societies was present.

Due to urgent European business, Gosta Vennerholm, Ford Motor Co., scheduled speaker for this meeting, was unable to be present. The speaking assignment was capably filled by Hugo W. Hiemke of the California Alloy Products Co. Mr. Hiemke's subject was *"The Use of Castings in Welded Assemblies."*

The speaker pointed out several advantages of castings such as the ability to make complex contours, being able to obtain specific compositions and economy of production due to methods of manufacturing. Several possible disadvantages of cast products were cited including the cost and time required to make patterns for small quantities.

At the conclusion of the talk a number of slides were shown of graphs, welded castings, and welded assemblies. Some of these slides showed that a complex casting could be redesigned into several smaller castings and welded together.

An active interest in the casting display was shown by all who attended. An excellent job was turned in by the casting display committee which consisted of Robert Haley, Chairman, Advance Aluminum and Brass Co.; Robert Gregg, Reliance Regulator Corp.; and William Emmet, Los Angeles Steel Castings Co.

All those who were entered in the apprentice pattern-makers contest were present. These men were: Daniel C. Burdick, Consolidated Pattern Works; Robert V. Bowers, Madsen Iron Works; Gordon Dally, Byron-Jackson Co.; Ralph Le Gault, Byron-Jackson Co.; and Albert Fowler, Eastside Patterns. First prize was awarded to Robert V. Bowers, second prize to Daniel C. Burdick, and third prize to Gordon Dally.

FUTURE CHAPTER

● APRIL 17
QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
M. E. BROOKS
Dow Chemical Co.
"Nodular Graphite in Cast Iron"

● APRIL 19
WASHINGTON
Seattle, Wash.
J. T. GOW
Electric Steel Foundry Co.
"Heat, Corrosion and Abrasion Resistant Alloys"
JOINT MEETING WITH ASM CHAPTER

CENTRAL MICHIGAN
Legion Club House, Battle Creek
W. B. MCFERRIN
Haynes Stellite Co.
"Gray Iron Casting Defects"

● APRIL 20
DETROIT
Engineering Society, Detroit
J. W. SHAW
Detroit Dept. of Health
"The Foundry Neighborhood Air Pollution Problem"

● APRIL 21
TEXAS
L. A. CLINE
American Steel Abrasive Co.
"Maintenance of Shotblast Equipment"

NORTHERN CALIFORNIA
Veneto's, San Francisco
L. P. ROBINSON
Werner G. Smith Co.
"Cutting Cost in the Core Room"

● APRIL 24
NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
F. G. SEFING
International Nickel Co.
"Casting Soundness as Affected by Gating, Risering and Gas Porosity"

● APRIL 28
CHESAPEAKE
Engineers' Club, Baltimore
R. A. QUADT
Hunter-Douglas Corp.
"Aluminum Foundry Practice"
PLANT VISITATION

TENNESSEE
Nashville, Tenn.
CLYDE A. SANDERS
American Colloid Co.
"Sand Control and Synthetic Sands"

● MAY 1
CHICAGO
Chicago Bar Association
ROUND TABLE MEETINGS

WESTERN MICHIGAN
Cottage Inn, Muskegon
R. P. SCHAUSS
Illinois Clay Products Co.
"Sand Properties and Casting Defects"

● MAY 3
MO-KAN
Fairfax Airport, Kansas City, Mo.
DR. KENNETH ROSE
"Crystallization and Grain Growth of Metallics"

● MAY 4
SAGINAW VALLEY
Fisher's Hotel, Frankenmuth, Mich.
C. E. NELSON
Dow Chemical Co.
"Research on Study of Metal Flow in Molds"

University of Minnesota

Delbert N. LeClaire
Secretary-Treasurer

CONDUCTED TOUR of the Minneapolis-Moline Power Implement Co.'s Lake Street plant was a highlight of the Student Chapter's February activities. The tour began with a short chapter business meeting at the plant.

Following this, H. H. Judson of Minneapolis-Moline discussed some of the foundry problems facing the plant's engineers, then conducted students through the plant's Foundry Division, pointing all the operations of the foundry's assembly line.

MEETING PROGRAMS

● **MAY 5**
WESTERN NEW YORK
Sheraton Hotel, Buffalo
ELECTION OF OFFICERS

● **MAY 8**
CINCINNATI DISTRICT
Engineering Society, Cincinnati
W. A. HAMBLEY
Wilson Foundry & Machine Co.
"Casting Defects"

● **MAY 9**
N. ILLINOIS-S. WISCONSIN
Beloit, Wis.
W. J. PHILLIPS
Steel Founders Society of America
"Castings vs. Weldments and Forgings"

ROCHESTER
Hotel Seneca, Rochester
ANNUAL STAG PARTY AND ELECTION

● **MAY 10**
SOUTHERN CALIFORNIA
Rodger Young Auditorium, Los Angeles
C. V. NASS
Beardsley & Piper Co.
"Progress in Mulling"

● **MAY 12**
PHILADELPHIA
Engineers' Club, Philadelphia
QUIZ NIGHT

● **MAY 13**
EASTERN CANADA
Mount Royal Hotel, Montreal
ANNUAL BUSINESS MEETING AND PRESENTATION OF APPRENTICE CONTEST PRIZES

● **MAY 15**
QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
W. E. SICHA
Aluminum Co. of America
"Aluminum Alloys—Fabrication and Applications"

● **MAY 17**
CENTRAL MICHIGAN
Lansing, Mich.
JOHN L. LOWETT
Michigan Mfg. Association
"Economics"

CENTRAL ILLINOIS
Jefferson Hotel, Peoria
W. H. FELLOWS
Bay State Abrasive Products Co.
"Refinements in Manufacture of Grinding Wheels"

● **MAY 18**
DETROIT
Rackham Memorial, Detroit
GROUP MEETINGS

● **MAY 19**
WASHINGTON
Gowman Hotel, Seattle
Film: *"Men and Molds"*

CENTRAL NEW YORK
Onondaga Hotel, Syracuse
R. G. MCELWEE
Vanadium Corp. of America
"Cupola Operation"

● **MAY 22**
CENTRAL OHIO
Chittenden Hotel, Columbus
SECTIONAL MEETINGS

● **MAY 25**
NORTHEASTERN OHIO
Tudor Arms Hotel, Cleveland
OLD TIMERS' NIGHT

● **MAY 26**
CHESAPEAKE
Engineers Club, Baltimore
ROUND TABLE MEETINGS

● **MAY 27**
SOUTHERN CALIFORNIA
Lakewood Country Club, Los Angeles
ANNUAL SPRING DANCE

N. Illinois - S. Wisconsin

Jerry M. Zilka
Gunite Foundries Corp.
Chapter Technical Secretary

JANUARY MEETING featured a talk by R. P. Schauss of Illinois Clay Products Co., Chicago, on *"Gating and Feeding of Castings."* Mr. Schauss described many of the gating systems in use throughout the country, pointing out their advantages and disadvantages.

In emphasizing the importance of gating molds in a manner that insures hottest metal in the feeder, Mr. Schauss said that this practice is helpful in obtaining desired directional solidification patterns.

Live feeders, Mr. Schauss continued, are more efficient than dead feeders (those receiving cold iron) and yield can therefore be increased by permitting use of smaller risers. Mr. Schauss' talk closed with a spirited question and answer session.

Following the technical meeting, H. Slusser of Gunite Foundries Corp. entertained the group with a newly-released naval film of the Okinawa invasion of World War II.

Philadelphia

A. J. Saute
Publicity Chairman

MAIN SPEAKER at the February 10 meeting of the chapter, held at the Engineers' Club, Philadelphia, was E. C. Troy, foundry engineer of Palmyra, N. J. Mr. Troy discussed foundry sands, trends in sand compounding, testing and uses. A lively question and answer period followed Mr. Troy's talk.

Canton District

Alexander Prentice
Stark Foundry Co.
Chapter Reporter

FEBRUARY 3 meeting, held at Mergus' Restaurant, Canton, was attended by 120 members and guests who saw the A.F.S. research film, *"Fluid Flow in Transparent Molds,"* narrated by Walter Bonsack of Cleveland.

The tests were conducted at Batelle Memorial Institute and show various types of gates and runners and how different pouring techniques affect quality of castings by either dissipating or entrapping air in molds.

Molten metal was represented in the transparent lucite molds by cold water mixed with finely ground aluminum powder. The speaker, who was one of

Also speaking at the February meeting of the A.F.S. Central Ohio Chapter was J. H. Jackson of Battelle Memorial Institute, Columbus, on "Flow of Metal in Molds."

the engineers on the project, claimed the water and aluminum used in the experiment simulated the viscosity of melted aluminum or magnesium.

Air is entrapped in the molds when turbulence is caused by uneven pouring speed, sharp turns in the runners, and where negative tapered or straight gates or sprues are employed. Air can also enter the molds through the sand whenever the atmospheric pressure is greater than the hydrostatic pressure of the stream of metal.

Western Michigan

F. W. Beetham
Campbell, Wyant & Cannon Foundry Co.
Publicity Chairman

MARCH 6 MEETING featured a talk by Dr. J. A. Ridderhoff of Frederic B. Stevens, Inc., Detroit, on *"Core and Mold Coatings."*

Dr. Ridderhoff explained in detail

the proper mixing procedures and equipment for producing good coatings, and answered questions of the audience during the discussion period following his talk on coatings.

Rochester

Donald E. Webster
American Laundry Machine Co.
Chapter Reporter

MARCH 14 MEETING, held at the Hotel Seneca, Rochester, featured a talk by Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio, on *"Cupola Refractory Practice."*

Mr. Barlow reviewed several methods of cupola patching in present-day use, including block, stone, muds of various types, and air placement. Hand patching requires a material with considerable plasticity with a correspondingly high moisture content and the more recent development of the air placement process has shown many advantages, the speaker said.

Whereas in hand patching the material must be adapted to the process, air placement allows the use of a carefully calculated mixture of grain material and clay substance, with a minimum of moisture introduced at the moment of application. The result is a longer-lived and more uniform patch having less tendency to sag or to spall off, Mr. Barlow said.

Extensive studies of cupola patching practices by the speaker have disclosed that the rate of burn-out is always more rapid during the earlier part of a heat, finally reaching a point where further destruction of the lining is greatly reduced. It follows then, he said, that the use of contour patching gives a more uniform cupola diameter throughout a heat, allowing a closer calculation of metal to coke ratios, and giving more uniform melting conditions.

The question period following Mr. Barlow's talk showed that foundrymen are keenly interested in these recent developments.

Quad City

R. E. Miller
John Deere Planter Works
Publicity Chairman

AN EXCELLENT TALK, spiced with discussion covering malleable gating and feeding was presented by B. C. Yearly, National Malleable & Steel Castings Co., Chicago, at the February meeting.

In explaining his gating theory, Mr. Yearly made reference to a law of science which says the carrying ability of a fluid is equal to the cube of the velocity. This justifies basins of larger area to reduce the velocity and settle out the dirt. More cleaning can be insured by placing baffle cores in the riser, the speaker said.

Feeding that is improper creates a vacuum within the casting, pulling in the wall. This shrink spot varies in location and can possibly be located in the drag. Such can happen when the cope is humped and the drag has a hot spot of sand. The normal change of volume upon solidification is 3 per cent, however each 100° of super heat increases the shrink 1 per cent, the speaker concluded.

Part of the crowd of foundrymen attending the March meeting of the Western Michigan Chapter, held March 6 at the Cottage Inn, Muskegon, Mich. (Photo courtesy Francis W. Beetham, Campbell, Wyant & Cannon Fdy. Co.)

Tennessee

Carl A. Fischer, Jr.
Fischer Supply Company
Reporter

REGULAR DINNER MEETING was held February 24 at the Hotel Andrew Johnson, Knoxville. The meeting was held in Knoxville for two purposes; to make it more convenient for members in the northeastern part of the state to attend, and to present to the University of Tennessee a complete technical library of A.F.S. publications for its engineering school.

Chairman Karl Landgrebe, The Wheland Co., presided and presented the library to Dean N. W. Daugherty of the University of Tennessee. The dean expressed the appreciation of the University and said it was really a valuable service to the youth of the community for A.F.S. to make this information available.

Vice-Chairman, Paul Arnold, U. S. Pipe & Foundry Co., in charge of the program, introduced the speaker, Dr. James T. McKenzie, American Cast Iron Pipe Co., Birmingham, Ala.

Dr. McKenzie illustrated his topic, *"Engineering Properties of Gray Cast Iron"* with slides and statistics. After his talk a question and answer period was held.

Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., was scheduled to be the second speaker on the subject, *"What's Ahead of the Foundry Industry?"* but was unavoidably detained in London, England.

On March 9 the Chapter was honored by a visit from A.F.S. National President E. W. Horlebein, National Secretary-Treasurer Wm. W. Maloney, and Mr. T. H. Benners, Jr., A.F.S. National Director from Birmingham.

Mr. Landgrebe announced the next meeting would be held in Nashville, at which time a complete library of A.F.S. technical publications would be presented to the Vanderbilt University School of Engineering.

Chesapeake

Jack H. Schaum
Bureau of Standards
Chapter Reporter

MARCH MEETING, held at the Engineers' Club, Baltimore, began with a buffet supper, followed by a coffee talk given by William Muth, vice-president of the Baltimore City Government, on city management.

Raymond C. Huntoon, Pressure Match Plate Co., Inc., spoke on *"Pressure Cast Aluminum Matchplates,"* in which he described how these matchplates are made by forcing aluminum under pressure into a plaster mold, resulting, he said, in fine finish.

Gates and runners may be cast on

(Continued on Page 172)

Newest Achievement in CARL-MAYER VERTICAL CORE OVENS

Only Carl-Mayer Vertical Core Ovens, with the heating system described, are protected by Patent No. 2,257,180. Other patents pending.

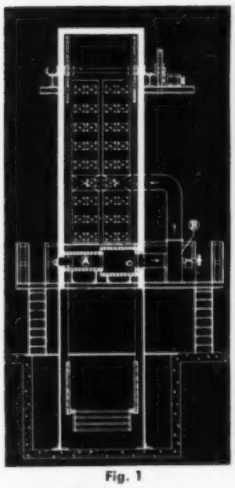


Fig. 1

OLD METHOD with heat fan external to oven.

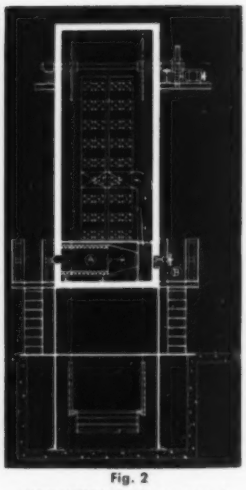


Fig. 2

NEW METHOD with heat fan inside oven.

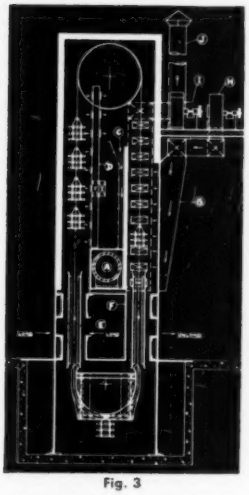


Fig. 3

Section showing conveyor travel, thru pass, heating, cooling and exhaust system.

Typical Users of CARL-MAYER VERTICAL OVENS

Aluminum Co. of America
Burt Foundry Co.
Cadillac Motor Co.
Eclipse Aviation Corp.
Electric Autolite Co.
Ford Motor Co.
Fremont Foundry Co.
General Motors Corp.
General Steel Castings Co.
Harrison Radiator Co.
Henry Kaiser
H. B. Salter Co.
McKinnon Industries
Quality Castings Co.
Packard Motor Co.
Richmond Radiator Co.
Union Brass and Metals Mfg. Co.
West Michigan Steel Castings Co.
A. C. Williams Co.

Vertical Ovens (Figs. 1, 2, 3) are by Carl-Mayer, using the universally adopted recirculating heating system with sealed combustion chamber located between conveyor chains.

CONSIDER THIS HIGHLY IMPORTANT NEW DEVELOPMENT OF LOCATING THE HEAT FAN INSIDE OF OVEN (Figure 2).

New added advantages are as follows:

(1) ***Saves platform space.***

(2) ***Eliminating external duct reduces heat losses.***

(3) ***Placing heat fan in oven also reduces heat losses.***

(4) ***Elimination of external heat duct and fan insulation results in lower installation cost.***

(5) ***Oven appearance is greatly improved.***

OTHER FEATURES

Guaranteeing—Faster Baking, Lowest Fuel Consumption, Smaller Core Losses, Safer Operation, Elimination of Smoke, Cooled Cores at Unloading Station, Reduced Labor Cost.

✓ The sealed combustion chamber (A) prevents hot combustion gases (1,200° or over) from going directly into the oven chamber, preventing non-uniform temperatures and burned cores.

✓ The alloy or refractory combustion chamber (A) located between conveyor strands, saves space as compared with vertical oven designs locating the heater external to the oven.

✓ The heat fan (B) takes the heated air from the combustion chamber and after tempering with fresh and recirculated air from duct (C) delivers it to the vertical plenum chamber (D). Result: fast, uniform circulation of heated air —faster baking.

✓ Plenum chamber (D) is arranged to insure uniform cross flow of heated air over each passing carrier shelf of cores. Result: uniform fast baking.

✓ The "Thru-Passage" (E) properly designed is an old practice used in ceramic drying. Permits loading from inside as well as outside.

✓ Arrangement of "Thru-Passage" as designed by Carl-Mayer, with partition (F), facilitates loading from both inside and outside of oven but limits the unloading to one side. This is a proven forward step, permitting adequate and fast unloading without the temptation to unload from the inside as well, with its resultant interference with loaders and danger of damaged cores.

✓ Cooling duct (G) and cooling fan (H) designed according to oven height and loading conditions, assure a uniform flow of cooling air across the cores on the down side to obtain maximum cooling.

✓ Cooling exhaust system, with cooling exhaust fan (I) and collector ducts, assures prompt and safe removal of combined cooling and exhaust products and smoke from the baked cores.

✓ Exhaust stack (J) utilizes the spent work of the cooling exhaust fan to further remove fumes and to prevent pocketing of any explosive gases.

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THE CARL-MAYER CORPORATION

3030 EUCLID AVE., CLEVELAND, O.

Core and Mold Ovens—all types. Backed by Over 30 Years' Experience

FOUNDRY Personalities

Herbert O. Jarvis has been elected a director of Continental Copper & Steel Industries, Inc., New York. Mr. Jarvis, who is general manager of Continental Copper's Niagara Falls Smelting & Refining Division, is also a vice-president of the parent company.

Richard S. Wharton, formerly vice-president in charge of sales of the Quaker Rubber Corp., has joined Hewitt-Robins, Inc., New York, as sales manager of the Hewitt Rubber Div. Mr. Wharton was with Quaker Rubber for 33 years, rising from clerk to vice-president. During World War II, Mr. Wharton served as a member of several industry advisory committees in Washington.

R. S. Wharton

Dean Lorin G. Miller of the College of Engineering, Michigan State College, has been appointed engineering consultant for the United States Radiator Corp., Detroit. Dean Miller, who has been active in the work of the Institute of Boiler and Radiator Manufacturers, will participate in development of U. S. Radiator products.

William F. MacDonald was recently elected president of E. F. Houghton & Co., Philadelphia manufacturers of industrial oils, leathers and chemicals. Mr. McDonald, who will continue to hold his former position as company treasurer temporarily, succeeds **Maj. Aaron E. Carpenter,** who voluntarily relinquished the presidency to become chairman of the board. It was also announced that **Dr. James T. Eaton,** Houghton manager of research, has been elected a director of the company.

Dean Uhll, western division sales manager, has been appointed export service manager for the Caterpillar Tractor Co., Peoria, Ill., succeeding **Ralph G. Dunn,** assistant general service manager, who has served as export sales manager for many years in addition to his other duties. It was also announced that Harrison Welch, formerly eastern division service manager, is to succeed Mr. Uhll as western division service manager. Mr. Welch will be succeeded by **D. L. Lammers,** a member of Caterpillar's Service Development Div.

E. V. Blackmun has been named chief metallurgist of the Die Casting Division of Aluminum Co. of America. He has been with Alcoa since 1934, shortly after his graduation from Tufts College and the Harvard University Graduate School of Arts and Sciences. Mr. Blackmun, who prior to his new appointment was chief metallurgist at Alcoa's Cleveland Works, has largely concentrated on work with permanent mold foundries. He is an active member of A.F.S. and was one of five Lecture Series speakers at the 1948 A.F.S. Convention.

E. V. Blackmun

Gray Lummis of the A. P. Green Fire Brick Co., recently resigned as vice-chairman of the A.F.S. Central Ohio Chapter because of business assignments that will necessitate his being out of town frequently. **Fred Davis** of the Oliver Co., Springfield, Ohio, succeeds Mr. Lummis as vice-chairman of the Chapter.

Charles Lessard, foreman of bench and machine molders at Canadian Westinghouse Co., Ltd., Hamilton, Ont., was recently presented with a 50-year A.F.S. pin at a meeting of the A.F.S. Ontario Chapter. Mr. Lessard's first molding job began in 1900 with McDonald & Largie, Granby, Que., first Canadian makers of cast iron bathtubs. After several years spent in Canadian and United States foundries, Mr. Lessard joined Canadian Westinghouse in 1920 as a bench molder. He was made foreman of bench and machine molders in 1931. His son, Edward, has been with Canadian Westinghouse for 16 years as a coremaker.

Harry G. McMurry has been appointed assistant manager of the Rouge Plant Production Foundry of the Ford Motor Co., Dearborn, Mich. Mr. McMurry began his foundry career in ferrous casting work with the Buick Motor Div., GMC, in 1927, remaining with that organization until 1946, when he joined Ford and was sent to Melbourne, Australia, to set up a modern automotive production foundry. Mr McMurry prepared initial plans for the project and was responsible for its entire development. The foundry was the first automotive facility built in Australia and was required to furnish castings for a production of 85 automobiles a day. Mr McMurry gained exceptional experience in dealing with problems involved in setting up this major industry. Since his return to the United States in 1949, he was employed as assistant superintendent of Ford's Pontiac, Mich., Foundry.

H. G. McMurry

Robert G. Settgas, a January, 1950, graduate of the Missouri School of Mines and Metallurgy, and a member of the A.F.S. Student Chapter there, has joined the Key Co., East St. Louis, Ill., as assistant plant engineer. Mr. Settgas served with the Army Engineers in World War II.

William B. McFerrin, formerly assistant manager of development, Electro Metallurgical Div., Union Carbide & Carbon

Corp., has been named Haynes Stellite Division executive vice-president. **Ralph A. Clark**, formerly in Electromet's Chicago office, has been named to succeed Mr. McFerrin as assistant manager of development for Electromet. Both Mr. McFerrin and Mr. Clark have long been active in A.F.S. committee work, and both are well known to Society membership for their frequent appearances as speakers.

J. K. L. Anderson, formerly melting shop assistant for the Stavanger Electro-Staalverk, Bergen, Norway, has been appointed sales engineer for the Als Bremanger Kraftselskab, Bergen. Mr. Andersen is a graduate of the Technical University of Norway and is a member of the American Foundrymen's Society.

C. A. Phalnikar of India, since 1948 a member of A.F.S., recently joined the Metals Research Laboratory of the Case Institute of Technology, Cleveland, as a part-time research assistant. Mr. Phalnikar came to the United States in 1945 as a student in metallurgical engineering at

C. A. Phalnikar

the University of Michigan, receiving his B.S. in 1948. Following this, he attended Case Institute of Technology for his M.S. in metallurgy, and upon receiving this degree in 1948 joined Elyria Foundry, Elyria, Ohio, as a helper under a cooperative arrangement made by Kirloskar Bros., Ltd., Kirloskarwadi, India, an organization for which he intends to work as metallurgist upon his return home this September after completing his work as research assistant at Case Institute.

Clifford F. Hood, president of the American Steel & Wire Co., has been elected president of the Carnegie-Illinois Steel Corp., succeeding Charles R. Cox, who resigned to become president of Kennecott Copper Corp. Mr. Hood joined American Steel & Wire in 1917 as an operating clerk, and after serving overseas in World War I, rose rapidly to presidency of the company. He is succeeded as president of American Steel & Wire by Harvey B. Jordan, formerly vice-president in charge of operations. James E. Lose, formerly vice-president in charge of operations of Carnegie-Illinois Steel Corp., has been

(Continued on Page 182)

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8

NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 616 S. Michigan, Chicago 5, Ill. Refer to the item by means of the convenient code numbers.

Portable Sander

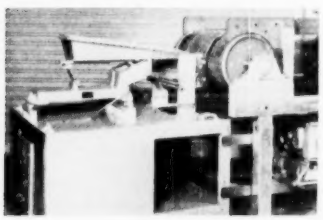
AP1—Portable air-powered sander is equally adaptable to medium duty sanding or light-duty cup wheel grinding. Design has been streamlined to reduce tool weight and size, improve tool balance and increase working efficiency. Sander is available in five models, with speeds of 7500, 6000, 4500, 3600 or 2400 rpm and is designed for use with 5-in. or 7-in. grinding pads. For cup-wheel grinding, wheel sizes of 4, 5 or 6 in. are indicated by specifications. *Buckeye Tools Corp., 21 W. Apple St., Dayton 1, Ohio.*

Colorimeter

AP2—Leitz Industrial Rouy-Photrometer provides colorimetric analysis of ferrous and non-ferrous metals and for die-casting. Designed to speed routine processing analyses, this instrument provides highest obtainable accuracy in colorimetric absorption analysis and gives concentration readings in which inherent functional error is cut to within 0.1 per cent. Operation is rapid and simple with no special operator skill required and identical readings can be obtained on same specimen by different operators. Compound compensating glass filters assure highest selectivity over entire visible spectrum. Unit is available for 6-volt d-c operation with four absorption cells, one sealed water absorption cell, plastic insert, dust cover and handbook. *E. Leitz, Inc., 304 Hudson St., New York 13, N. Y.*

Magnetic Agitator-Separator

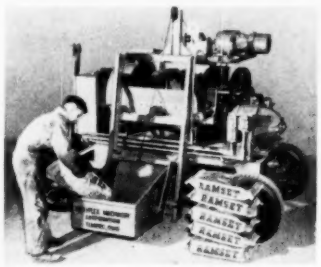
AP3—Designed to separate small amounts of non-magnetic material from



large amounts of magnetic material, the Eriez Non-Electric Agitator-Separator will recover steel grindings from abrasive grit, for example, or non-magnetic chemicals from iron shot. Unit also separates fine magnetic scrap from non-magnetic cuttings. Unit consists of permanent magnetic pulley, receiving chute or vibrator tray, vane assembly and moving belt. *Eriez Mfg. Co., Erie, Pa.*

Portable Mixer-Skip Loader

AP4—Portable multi-blade mixer with skip loader is specifically designed for refractory mixing. Consisting of a multi-blade mixer mounted on a four-wheeled pneumatic-tired truck, unit has skip-loader arranged on carrier in such a manner that standard wheelbarrows can be located on opposite side to receive material. Design eliminates need for special plat-



forms, rigs, etc. Mixes are completed, according to manufacturer, in three to four min. Unit is effective in reducing "balling up" of fines because it minimizes segregation. Skip loader is operated through brake-type motor and is equipped with ledge for ease in dumping bags of refractory material. All or any portion of mixed material can be discharged as desired. Truck is equipped with standard automobile wheels and pneumatic tires. Front wheels turn and unit is equipped with pulling tongue. Mixers are available in 3, 5, 7 and 12 cu ft capacity. *Multiplex Machinery Corp., Elmore, Ohio.*

Mercury-Cathode Analyzer

AP5—Dyna-Cath, developed by Battelle Memorial Institute, Columbus, Ohio, employs the mercury cathode process for separating interfering metals, cutting analytical time as much as 75 per cent and making analyses previously considered too costly for routine laboratory use. Differing from conventional mercury-cathode equipment, unit has magnetic circuit which causes rapid countercurrent stirring at mercury-electrolyte interface, continuous cleaning of mercury surface, and minimum re-solution of deposited metals. Unit is

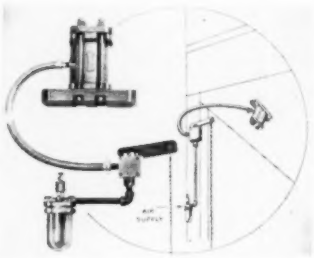
designed particularly for use in determining aluminum in steel and in zinc-base alloys; zirconium in iron and steel; and uranium, alkali earths and alkali metals in alloys of iron, copper, nickel, chromium zinc, molybdenum and other metals. *Eberbach & Sons Co., Ann Arbor, Mich.*

Molybdenum Lubricant

AP6—Molybdenum lubricant to replace or supplement lubricating oils and greases, "Liqui-Moly" is now available in a form suitable for use in any conventional lubricating system. Molybdenum, an extremely greasy metal is practically indestructible at high temperatures and pressures, certain forms of it having the faculty of "plating" to any friction surface, thus protecting bearings against scoring or seizing even after the oil has been burned out. Tests have shown that friction surfaces running at high speed and under heavy pressure will heat up from 300 to 504 per cent faster with lubricating oil than when running dry with only Liqui-Moly, and that the temperature rise with oil is continuous until failure and seizure, whereas with Liqui-Moly it reaches a stabilization point and then usually recedes. Material is chemically stable and is unchanged by temperature extremes. Liqui-Moly is available in sample quantities at $2 per lb from *The Lockery Co., College Point, L. I., N. Y.*

Vibrator Installation Kit

AP7—LVF Vibrator Kits, consisting of a pneumatic vibrator, control valve and air line lubricator, will meet a wide range of materials handling applications. Containing all parts necessary for rapid, easy attachment of vibrator assembly to hoppers and storage bins, LVF Kit comes furnished with any one of six vibrator



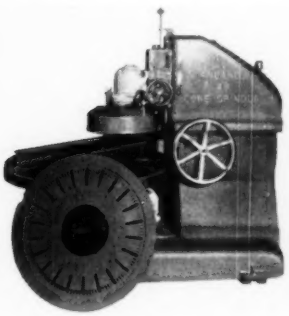
models, with piston diameters ranging from 1¼ to 4 in., over-all widths from 3 to 7½ in., and over-all lengths from 6 to 15 in. Extra large and heavy duty models can be supplied on request. *Cleveland Vibrator Co., 2786 Clinton Ave., Cleveland 13.*

Overhead Handling System

AP8—A new Trambeam monorail materials handling system, designed for economical overhead handling of light loads or short spans, is interconnectable with conventional Trambeam systems. Consisting of one-piece rail section of high carbon steel, unit has flat tread of exceptional wearing quality. Rail and hangers are flexibly suspended to eliminate torsion on hanger rods and to equalize wheel loads. "T-Beam" will be engineered, fabricated and erected to suit individual job. *Whiting Corp., Harvey, Ill.*

Table Core Grinder

AP9—New 48 in. diameter table core grinder incorporates relatively few parts for greater economies in operation and maintenance. Mounted on large precision roller bearings for rapid and accurate



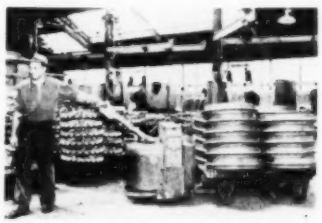
core grinding, table can be controlled either manually or by adjustable speed reducer operated by 1 hp motor. A ¾ hp motor mounted on counterbalanced sliding head furnishes direct power to grinding wheel, which is easily adjusted in any vertical setting. Core grinder eliminates hand rubbing of cores. *Standard Pattern Works, 804 Francis Palms Bldg., Detroit 1.*

Blast Cleaning Abrasive

AP10—Black Beauty, a newly-developed abrasive designed to replace silica sand for blast cleaning and finishing operations, is non-metallic and silica-free. This sharp, fast-cutting abrasive retains its abrading qualities even when reduced to very fine material. Although Black Beauty has much the same properties as sand, there is no free silica. Abrasive is claimed by manufacturer to wear 2 to 3 times longer than sand, is less damaging to equipment, is non-corrosive and stainless, flows freely and does not rust, pack or harden. Abrasive is supplied in a variety of sizes for any type of work or finish desired. *American Wheelabrator & Equipment Corp., Mishawaka, Ind.*

Electric Lift Truck

AP11—Power Ox electric lift truck illustrated is carrying 22 idler wheel castings weighing 150 lb each, or, according to the manufacturer, a load equal to that of two



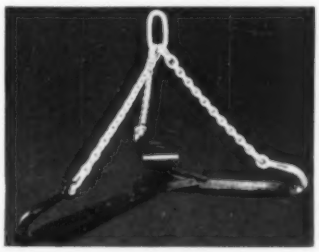
hand lift trucks. Unit is designed for one-man operation and does away with lifting, tugging and straining on part of operator. Finger tip control raises and lowers load, operates forward and reverse speeds, steers and brakes unit. *Barrett-Cravens Co., 4609 S. Western Ave., Chicago.*

High Temperature Tester

AP12—No. 785 Thermolab, a complete high temperature testing laboratory for research and control work on molding and refractory materials, will make such tests as hot strength, collapsibility rate under load, spalling, expansion, contraction, hot permeability, gas pressure and volume, retained strength under various atmospheres and different temperatures ranging from room to 2800 F. A load of 0 to 1000 psi can be applied to specimens at a rate of table rise ranging from 0 to 3 in. per minute. Loading and weighing of specimens is accomplished by motor-driven hydraulic system. *Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.*

Cupola Sling Chains

AP13—A new line of cupola sling chains claimed by manufacturer to speed up handling of cupola lids while increasing



safety factor during operation is made with square ends and flat sides to fit securely into sockets in cupola lid. Hook angle is fixed to provide for horizontal lift at all times. Safe working load capacity is 24,000 lb. *Woodhouse Chain Works, Trenton, N. J.*

Power Hammer-Drill

AP14—Hamer-Dril, an adaptor which is chucked in any ¼ in. electric drill, converts drill into compact efficient electric hammer for use in overhead, scaffold and close-quarters work where heavier hammers are awkward. Feature of Hamer-Dril is built-in shock absorber which protects electric drill and eases operator fatigue. Weighing less than 3 lb, unit has 9/16 in. hex opening which will accommodate other tools. *Hamer-Dril Co., Box 158, Planetarium Station, New York 24, N. Y.*

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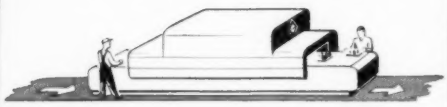

3 STEPS YOU CAN ELIMINATE

Eliminating these 3 steps with the *Foundromatic* Sand Core dryer means you cut core making time from days to minutes.

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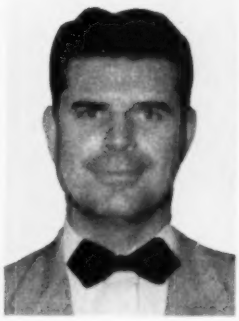

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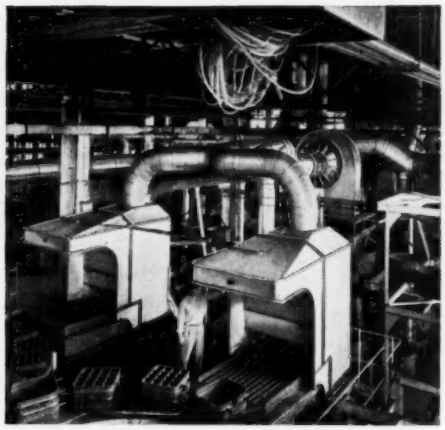
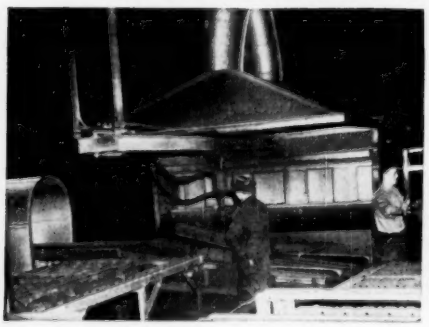


Dust control system on production line shake outs in a well-known midwestern foundry.

Dust control system on sand handling equipment, one of 17 KIRK & BLUM installations in a large Chicago foundry.



Unretouched photo shows shakeout hood in the Michigan foundry of an automotive parts producer.

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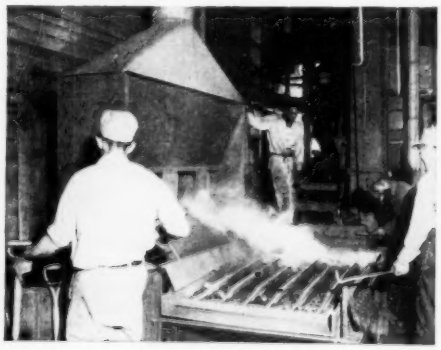

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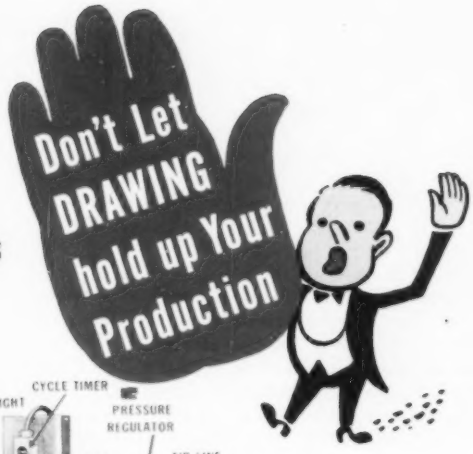

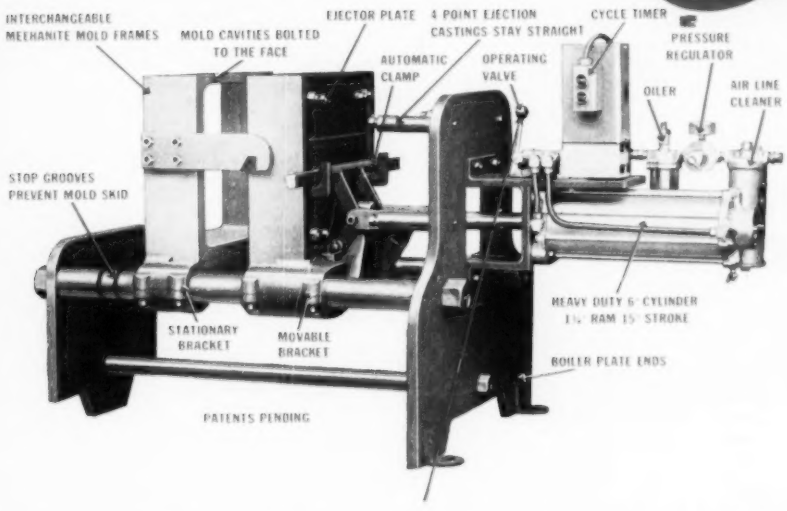

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Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Refer to the items by means of the convenient code numbers.

Combustion Safeguards

AP101—Series 1300 Flame-O-Trols, combustion safeguards for oil and gas-fired furnaces, ovens, boilers, kilns and other heating equipment, are described in a four-page folder. Economy, maintenance, operating and safety features are outlined. *Wheelco Instrument Co., Chicago 7, Ill.*

Strainer Core Shapes

AP102—A four-page folder on refractory strainer core shapes describes how Harbison-Walker high-strength, erosion-resistant ceramic cores eliminate slag and sand inclusions. These strainer shapes are made from a hard, strong material molded under pressure and kiln-fired at 2400 F. Folder includes technical data on sizes and weights, and a table indicating rate of metal delivery through cores under various head pressures. *Harbison-Walker Refractories Co., Pittsburgh 22, Pa.*

Dust Control

AP103—An industry report, "Use of Dust Collectors in the Metal Industry," illustrates methods of using dust control to improve working conditions and quality control, to lower maintenance costs and provide more efficient production on such costs as grinding, blast cleaning and saw glazing. Ask for Bulletin No. 262. *American Wheelabrator & Equipment Corp., 3 South Byrkit St., Mishawaka, Ind.*

Industrial Radiography

AP104—A 16-page catalog of industrial radiography materials describes films for use with x-ray equipment of varying kilovoltage and with specimens of varying thickness and density. Information on relative speeds and contrast of different x-ray film emulsions is provided in a handy chart to enable the radiographer to select material best suited to his needs. Additional information is provided on the use of intensifying screens. *X-Ray Div., Eastman Kodak Co., 343 State St., Rochester 4, N. Y.*

Aluminum Casting Alloys

AP105—40-page illustrated booklet, "Aluminum Casting Alloys," is offered without obligation. Written as an educational and reference text, as well as a practical guide for foundrymen, the booklet contains sections on pouring, shrinkage, dross control, solution treating, aging, stress relief, corrosion, test bars, gas absorption and effect of moisture. Metallurgy of aluminum casting alloys is described in detail, with explanations as to how these alloys are affected by copper, silicon, magnesium, manganese, iron, zinc, nickel and titanium. A complete tabulation of sand, permanent mold and die-casting alloys' specifications includes nominal compositions, mechanical and industrial properties. *Dept AE, Federated Metals Div., American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.*

Armour Research Report

AP106—Descriptions of more than 200 research projects undertaken by Armour Research Foundation scientists during 1948-49 are given, ranging from a noise survey of a city to economic developments for an entire country. *Technology Center, Armour Research Foundation of Illinois Institute of Technology, Chicago 16, Ill.*

Silvery Pig Iron

AP107—Jisco Silvery, a high silicon blast furnace pig iron is described in a six-page folder. Use in gray iron and malleable iron is shown, with typical charges for each, as well as Jisco Silvery's applications to steel making. Only virgin ores are used in the making of Jisco Silvery. Smelting is a slow, soaking process which makes use of a low ash, low sulphur, non-coking seam coal, along with coke to secure richer gases and higher heats. *Jackson Iron & Steel Co., Jackson, Ohio.*

Battery Selector Bulletin

AP108—Battery Selector Bulletin GB-1055 is designed to guide materials handling supervisors, plant engineers, battery room foremen and purchasing agents in the selection of correct batteries for industrial trucks. Described in the eight-page catalog are "Thirty" and "Kathanode", with exploded view drawings of each. Catalog concludes with two pages of engineering specifications for almost 100 different size and capacity batteries. Data includes number of plates per cell, ampere hour and kilowatt hour capacity at six and eight hour rates, discharge in amperes at six-hour rate, recommended finishing charge rate, cell dimensions, etc. *Gould Storage Battery Corp., Trenton.*

Zircon Foundry Sand

AP109—Uses of zircon in the foundry for casting alloy and carbon steel, gray iron and bronze are described in a five-page folder. Following a general description of zircon foundry sand, its supply, control and properties, the booklet outlines its advantages in foundry work—high diffusity coefficient, refractoriness, fine grain size and chemical inertness. Also described in detail are zircon sand practices, together with a number of sand mixes for casting various types of metal as practiced successfully in leading foundries. Booklet concludes with zircon applications. *Millmaster Chemical Corp., 420 Lexington Ave., New York 17, N. Y.*

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1	Alloy Cast Irons Handbook (2nd Edition)	$2.75	$ 4.50
2	Aluminum Foundry Process Control (SAE)	1.00	2.50
39	AFS Foundry Apprentice Course Outline	1.00	2.00

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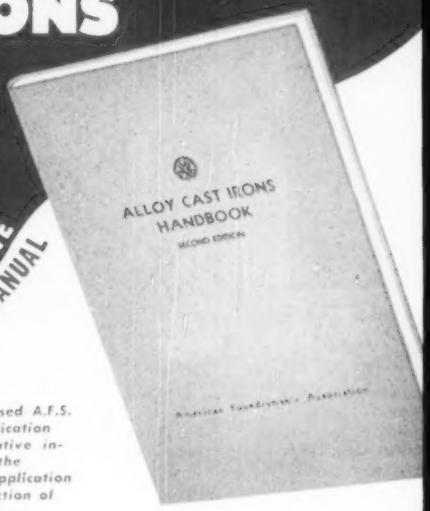

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ALLOY CAST IRONS is a "must" in the gray iron foundryman's reference library. PRICE: $2.75 to A.F.S. MEMBERS. $4.50 NON-MEMBERS.

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29	AFS Apprentice Training Standards for the Foundry Industry	1.00	2.00
27	AFS "Transactions" Vol. 51 (6x9)	3.00	15.00
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CHAPTER ACTIVITIES

(Continued from Page 158)

the plate or added after foundry practice has been established, the speaker concluded. Mr. Huntoon illustrated his talk with slides and showed samples of master patterns, core plugs, plaster molds and matchplates.

Missouri School of Mines

James B. Templeton
Chapter Reporter

Speaker at the February 23 meeting was Dr. Lee H. DeWald, National Cylinder Gas Corp., Chicago, who spoke on *"Industrial Gases and Their Application to Metallurgy."* The slides which accompanied the talk illustrated some of the equipment used in the production and application of industrial gases to metallurgical processes.

This was homecoming for Dr. De Wald, who graduated from the School of Mines, Class of 1933. He received his master's degree from M.S.M. in 1935 and several years later a Ph.D. from M.I.T.

Lloyd C. Farquhar, Sr., American Steel Foundries, St. Louis, National Director of A.F.S., attended the meeting. The purpose of Mr. Farquhar's visit was to make recommendations for the improvement of the chapter. He stated that with the assistance of members of the St. Louis District Chapter, the M.S.M. chapter is doing very well and that no recommendations are necessary.

March 9, 30 members of the chapter went to St. Louis. In the morning the group toured the plant of the National Bearing Division of American Brake Shoe Co., and in the afternoon toured The Key Co. In the evening the members of the group were the guests of the St. Louis District Chapter's dinner meeting.

Southern California

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Publicity Chairman

GUEST SPEAKER at the March 10 meeting was R. A. Quadt, Hunter-Douglas Corp., Riverside, Calif., speaking on *"Aluminum Alloy Castings."*

The talk was incorporated with the showing of slides revealing casting defects. Before continuing on to each new slide, Mr. Quadt thoroughly explained what type of defect each slide portrayed and explained the cause, as well as the correction of same.

The speaker stated that the stirring of melted aluminum is not needed. If stirring is desired, some protection from the stirring rod should be made. Along this line, a slide was shown of a sand cast aluminum casting, which had two per cent iron pick up in it. This

pick up was due to use of an uncoated cast iron pot. If cast iron pots are used, they should be coated daily. A preferable method would be the use of a refractory crucible, the speaker said.

A slide of a riser having extreme pin hole porosity was viewed. Employing drastic chills to get the heat out of a mold was named as a method to correct this condition. Sand is an insulator and therefore the only way to get the heat out of the mold is proper risering and planned chilling. Porosity caused by shrinking or gas is similar in appearance, Mr. Quadt said.

Another interesting slide shown was of a large body of iron sludge taken from the bottom of a refractory crucible. Mr. Quadt pointed out that when pigs are added to a melt, the pig goes to the bottom and dissolves (as sugar would), and does not melt. As a result of this procedure, a small amount of iron from each pig goes to the bottom of the crucible and accumulates there.

Turbulence in pouring of a casting results in trapped gasses, he said. Castings made under this condition may look extremely sound after they are poured, but after a top skin is removed from the cope side of the castings, cavities are visible. Locating the sprue close the corner of the mold and having the lip of the ladle close to the sprue to prevent the long drop of metal which causes the turbulence is the correct procedure to follow to eliminate this condition, Mr. Quadt added.

The fallacy of sometimes having too many patterns on a plate was pointed out by Mr. Quadt. When this is done sufficient gates and risers are limited, which results in casting defects.

Following the talk and question period, the motion picture, *"Behavior of Molding Sands at Elevated Temperatures,"* was shown through the courtesy of the Harry W. Dietert Co., Detroit, Mich.

Mo-Kan

Thomas F. Shadwick
Witte Engine Works
Chapter Reporter

MARCH 1 MEETING, held at Fairfax Municipal Airport, featured as speaker Kurt Miericke, Baroid Sales Div., National Lead Co., Chicago, who spoke on *"Insulating Risers as an Aid to Feeding Risers."*

Mr. Miericke said that the foundryman must know the right place to use exothermic insulators and explained that some metals are contaminated by insulators. Gypsum plasters are recommended for non-ferrous castings only and volcanic ash products and bentonite are acceptable for ferrous castings, he said.

The insulating material is used to form a wall around the riser feeders.

(Continued on Page 175)

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FOUNDRY FIRM Facts

James M., Bryce F. and Charles Moffat, who last year sold their interests in Moffats, Ltd., Weston, Ont., have purchased the **Empire Stove and Furnace Co., Ltd.,** Owen Sound, Ont., a modern sheet steel and enameling plant which also specializes in custom cast iron. Assets of the 50-year-old company include a modern twin-cupola foundry and a pattern shop in addition to sheet metal fabricating and warehousing facilities. The new owners plan immediate production of a revolutionary new line of gas and electric commercial cooking equipment.

H. K. Ferguson Co., industrial engineering firm of Cleveland, New York and Houston, announces the acquisition of the **O. D. Conover Engineering Co.,** Cleveland, foundry design and construction firm. The staff of the Conover organization will form the nucleus of a newly-established Foundry Division of the Ferguson Co. and will be headed by Oliver D. Conover, who directed the operations of his firm since its founding in 1932. The purchase was made by the Ferguson Co. in anticipation of the expenditure of large sums by the nation's foundries for expansion and modernization during the next several years.

Northeast Industrial Equipment Co., Inc., Cambridge, Mass., is now handling the **Hyster Co.'s** line of lift trucks, straddle trucks, and mobile cranes in a territory comprising Maine, New Hampshire, Rhode Island, and 10 counties of Massachusetts. Northeast maintains offices, a parts department, service facilities, a rental department and showroom at 303 Binney St., Cambridge.

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., announces the appointment of three manufacturer's agents: **Miller-Joyce,** 122½ S. Vermont Ave., Los Angeles, to handle hydraulic presses and related equipment in Southern California and Arizona; **Whitty Engineering Co.,** 10 High St., Boston, to handle hydraulic presses and related equipment in the New England states; and **J. R. Allen Co.,** 402 Swetland Bldg., Cleveland, to act as agents for Birdsboro rough and machined steel castings in Ohio, with the exception of counties in eastern Ohio bordering on Pennsylvania and West Virginia.

O'Brien Industrial Equipment Co., 1295 Folsom St., San Francisco, has been appointed sales representatives for the **Eriez Mfg. Co.'s** line of magnetic separators and will offer technical engineering assistance free-of-charge to purchasers of Eriez magnetic separation products.

American Brake Shoe Co. announces the consolidation of all operations of its Canadian subsidiaries into one corporation, **Dominion Brake Shoe Co., Ltd.,** Montreal, a wholly-owned subsidiary. The operating assets and businesses of **Joliette Steel, Ltd.,** and **Ramapo of Canada, Ltd.,** were acquired by Dominion Brake Shoe, which will operate all Canadian plants of the parent company through five divisions—**Brake Shoe Div., Joliette Steel Div., Canadian Ramapo Div., American Brakeblok Div.,** and **Kellogg Div.** Dominion Brake Shoe will make its principal office at 1405 Peel St., Montreal, Que., and will continue to operate plants at Lindsay, Niagara Falls, St. Thomas and Joliette.

Wark Foundry Services, Inc., 97 Woodcrest Blvd., Kenmore 17, N. Y., is a new organization formed by John R. Wark, chairman of the A.F.S. Western New York Chapter, to handle Buffalo area sales of the products of Black Sivalls & Bryson, Inc.; Spo, Inc.; Cleveland Metal Abrasive Co.; Smith Facing & Supply Co., Lauhoff Grain Co., and others.

Ideal Industries, Inc., Sycamore, Ill., recently purchased the entire business and assets of **Tincher Products Co.,** Chicago manufacturer of a process for sealing porosity in castings. A. B. Tincher, originator of the process, will continue with the company in an active sales engineering capacity. Larger facilities of the new company will enable the subsidiary to develop a greatly expanded line of equipment for applying the Tincher process and plans call for sales, engineering and service representation in at least seven strategic foundry areas, in addition to the Chicago area, which will be served from Sycamore.

Whiting Corp., Harvey, Ill., announces the appointment of four new distributors for its line of electric hoists: **Wisner, Inc.,** Rockford, Ill.; **Neff Equipment Co.,** Toledo, Ohio; **Stone Supply, Inc.,** Houston, Texas; and **Barton Sales Co.,** Ft. Wayne, Ind. Barton Sales Co. has also been named distributor for Whiting's Trambeam overhead crane and monorail systems.

U. S. Reduction Co., Chicago, has acquired a new plant in Toledo, Ohio, for the production of finished ingot. The new plant is manned by personnel selected from U. S. Reduction's East Chicago plant and has a complete research and chemical staff to assist foundrymen to solve their problems. It was also announced that the company has appointed the **J. B. Neiman Co.,** 729 Fisher Bldg., Detroit, as sales engineering representative in Michigan.

Casting Company Publicizes Part It Plays In Community

Keeping citizens of Decatur, Ind., aware of castings and the foundry industry, the Decatur Casting Co., recently displayed a number of its products in the local Chamber of Commerce window to show its contribution to the city's commerce and industry and to report its safety record. The company's no lost time accident record extends back to August 2, 1948. Since 1943, Decatur Casting Co. has received seven achievement awards for safety, four from the National Safety Council.

CHAPTER ACTIVITIES

(Continued from Page 173)

These forms are made up as core boxes and may be made in round, square, oblong, or wedge shape.

When forming these insulated riser feeding cores for non-ferrous castings, a mixture of 100 per cent Gypsum Plaster and 80 per cent water is mixed and poured into the corebox forms. The material is quick setting. These cores after drying are ready to use. Some of the benefits derived from using these exothermic insulated riser feeding cores are: reduction of cope depth; reduction of riser length; yield percent raised for metal cast; saving in alloys; increase in production by handling of less material and by reducing the number of defective castings, Mr. Miericke concluded.

There was a meeting of all members following the technical session, in which the new chapter by laws were read and accepted by unanimous vote. These by laws were drawn up by a committee of three Directors: Les Neville, Neville Foundry Co., North Kansas City, Mo.; E. C. Austin, National Brass Foundry Co., Independence, Mo.; and Milton Gold, Gold Foundry and Machine Co., Independence, Mo.

Oregon State College

RECENT MEETINGS of the Student Chapter have featured a showing of the A.F.S. research film, *"Fluid Flow in Transparent Molds,"* and a talk by Dr. J. G. Jensen, head of Oregon State College's Geography Department, who discussed *"The Geo-Strategy of the Western Iron and Steel Industry,"* depicting the present and future status of the iron and steel industry.

Central Illinois

John R. Nieman
Caterpillar Tractor Co.
Chapter Reporter

SPEAKER at the March 6 meeting, held in Peoria, was T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va., who discussed *"Applications of Synthetic Resins as Core Binders."*

Mr. Curry outlined the use of synthetic resins as experienced by the Lynchburg Foundry Co., which started using them experimentally in 1945. Currently 80 per cent of Lynchburg's core production is with resin sand mixes. This represents 22,000 tons of sand since February, 1948. To date all applications have been in cores for grey iron. A total of 28 resin products by 15 manufacturers were used experimentally, the speaker said.

In the preparation of mixes, the base sands must be free of clay and

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Defective Castings Salvaged

WITH THE DOT-WELD PROCESS

A proven method of efficiently filling ferrous and nonferrous surface defects in castings. No hard spot—4 times faster than any present method. You can also salvage machined castings that show defects. Ideal for welding aluminum to patterns.

Small to large foundries and pattern shops booster.

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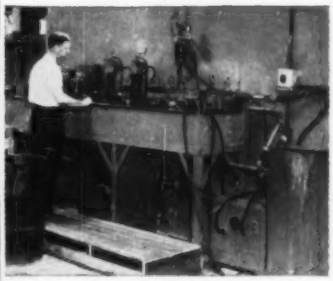

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Mogul Cast Seal Process will solve your problem by circulating or by vacuum impregnation. All ferrous or nonferrous castings can be impregnated—no muss or baking—casting sealed will stand any test.

Photo shows M-1000 circulator used for testing and impregnating pump castings.

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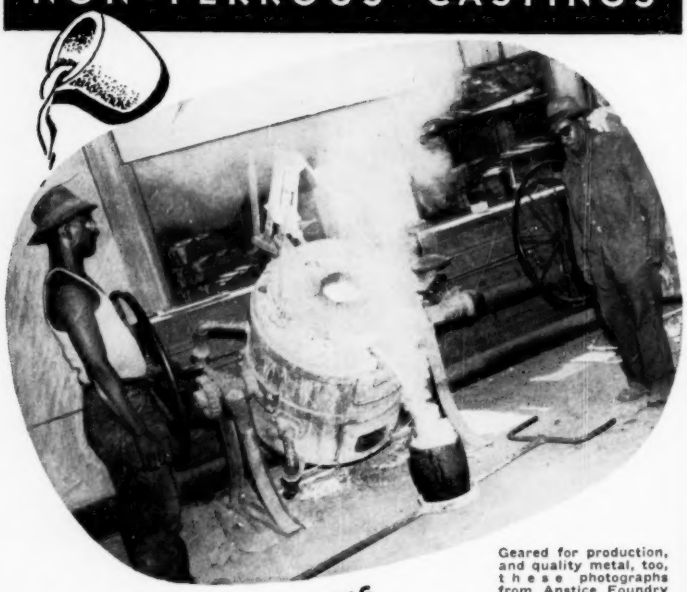

Geared for production, and quality metal, too, these photographs from Anstice Foundry at Rochester, N. Y., show how maximum melting is handled year after year without interruption.

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Both melting and carrying are done in Crucibles in this outstandingly successful foundry. Here twelve analyses of copper alloy ingot are melted in addition to four analyses of aluminum, including heat-treated aluminum. Surely a test of the versatility and adaptability of Crucible melting.

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bentonite. Baking cycles must be closely controlled for overbaking cannot be tolerated, Mr. Curry added.

Cores are made by blowing, power and hand rollover, and benches, he said. Sag problems have been a factor in limiting the resin mix to 80 per cent of Lynchburg's core production. Resin and oil cores made from the same corebox are not totally interchangeable, the speaker added.

Summarizing advantages of synthetic resin bonded cores, Mr. Curry pointed to reduced cost—shorter baking cycles—and improved molding sand control. Disadvantages were counted as the need for refrigerated storage for synthetic resins—base sands being free from clay—and close control of baking.

Intensive question period discussion revealed the keen interest shared by all in this relatively new technique.

Inspecting a display of castings at the February 10 meeting of the Southern California Chapter were, left to right: Louis Delaney, Reliance Regulator Corp.; Earl Anderson, Enterprise Iron Works; and A.F.S. National Director Robert Gregg of Reliance Regulator Corp.

Metropolitan
Carl Szego
Moldcast Products, Inc.
Publicity Chairman

JANUARY MEETING, held at the Essex House, Newark, N. J., consisted of four round table discussions on the subject of *"Melting Practice."*

The main topics of discussion of the Steel group, led by D. W. Talbott, Cooper Alloy Foundry Co., Hillside, N. J., were:

1. The use of oxygen in melting steel and resultant lowering of the carbon content of the melt, improvement of quality and the reduction of costs through saving in power, refractories and furnace labor costs.

2. The use of the x-ray machine as a

pilot instrument to check different methods of gating and the cost of producing castings made in accordance with these various methods. The large savings which can be realized by very slight increases in yield through study of gating systems was brought out.

3. Comparison of cleaning costs through the use of various types of shot by actual tests.

The Brass and Bronze discussion group was led by B. A. Miller, Baldwin Locomotive Co., Philadelphia, Pa. Subjects discussed were:

1. The proper furnace atmosphere for the melting of brass and bronze and its control, both visually and by testing with zinc.

2. The effect of harmful gases, hydrogen and water vapor, in tin-bronze castings.

3. The deoxidation of aluminum bronze by the use of magnesium.

4. Furnace linings and the importance of their chemical compositions.

R. E. Ward of the Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J. led the discussion on light metals. This group discussed many aspects in the making of aluminum and magnesium castings, among them being the use of various types of melting furnaces and the use of refractory crucibles vs. iron pots in the melting of aluminum, the effect and elimination of harmful gases in the melting of aluminum, and the effect of impurities on the physical properties of heat treated aluminum castings. Also discussed at length were magnesium-cerium and magnesium-cerium-zirconium alloys.

The Gray Iron group, led by C. L. Lane, Florence Pipe Foundry and Machine Co., Florence, N. J., discussed principally the operation and maintenance of the cupola. One of the subjects covered at length was the lining and patching of the cupola, particularly the melting zone, the use of various patching mixtures, and the methods of application. Also covered was the subject of hand versus machine charging of the cupola.

An interesting point brought up was the feasibility of overnight banking of the cupola, which is being done successfully in some foundries.

The February meeting of the Metropolitan Chapter was held at the Essex House, Newark, N. J. on February 6.

The speaker for the evening was J. H. Rickey, Ironton Fire Brick Co., Ironton, Ohio. His subject was *"Modern Foundry Refractories."* Mr. Rickey used slides in his talk and these slides showed how the various refractories are manufactured.

Mr. Rickey also stressed the use of plastic fire brick for the lining of various foundry ladles and a number

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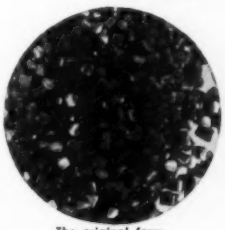

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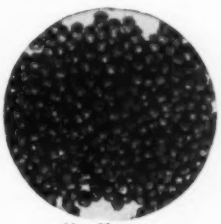

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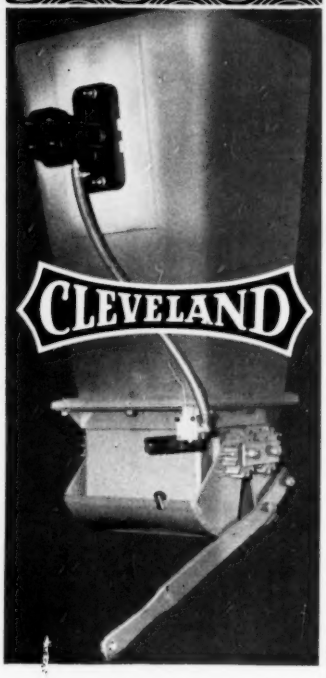

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of the slides showed the proper procedure as to how plastic fire brick should be installed.

About 90 men were in attendance and after Mr. Rickey's talk there was a very lively discussion.

Before John Bing, Metropolitan Refractories Corp., New York, introduced Mr. Rickey, he gave a brief history of the refractory industry in the United States, stating that the first plant built for manufacturing fire brick was near Woodbridge, N. J. in the year 1825 and was known as the Salamander Works. He then traced the westward movement of the industry. Mr. Bing was technical chairman of the meeting.

Washington

Harold R. Wolfer
Puget Sound Naval Shipyard
Chapter Reporter

JANUARY 20 MEETING, held at the Gowman Hotel, Seattle, featured a talk by J. E. Rehder, Canadian Bureau of Mines, Ottawa, Ont., on "Nodular Iron," and an announcement that the Chapter plans to hold a sand school in the near future.

A distinguishing characteristic of nodular iron pointed out by Mr. Rehder is its smooth spheres of graphite. This condition makes possible higher physical properties than are obtainable with malleable iron in which the graphite nodules have rough surfaces.

These rough surfaces act as stress raisers or weakeners of the structure of malleable iron while the structure of nodular is relatively free of stress raisers. Also, the nodules of ductile iron are apparently made up of tiny crystals while the graphite nodules of malleable iron are made up of tiny flakes of graphite or temper carbon.

Magnesium, cerium, lithium, strontium, and barium are elements which will cause the graphite to take the nodular form in cast irons, Mr. Rehder reported. Of these, magnesium is the least expensive to use.

Anyone, he said, can make nodular iron in ordinary melting units, cupola, induction furnace, or arc furnace, by exercising control over the following elements in the base iron along with the addition of the required amount of magnesium:

Carbon from 2½ to 4 per cent will permit nodulation, but an iron with carbon in the range 3½ to 4 per cent C. will be easier to produce in the nodular form. A desirable range is 3.40 to 3.70 per cent C.

Silicon content 2.50 - 2.70 and not over 3.0 per cent is desirable. Irons with less than 2.40 per cent Si are likely to chill. For higher ductility the silicon content may run over 3.0 per cent.

Manganese, which is a strengthener and carbide stabilizer in cast irons, must be kept low in nodular irons so that ferrite can form, a desirable range being not over .40 down to .10 Mn.

Phosphorous has a great effect on nodular iron. P content must be kept under .15 - .20 and .04 - .06 is better. Materials in charge must be low in phosphorous. Mr. Rehder suggested a mixture of steel and bessemer pig.

Sulphur content of iron being treated doesn't matter except that sulphur is acted upon by magnesium, which is a powerful desulphurizer. Therefore, lower sulphur content means less magnesium consumed in this reaction, and consequently, more residual or working magnesium available from a given addition for the job of producing nodular iron.

Mr. Rehder said that working magnesium (that capable of causing nodule formation) may be determined by subtracting residual S from residual Mg. Working Mg of .04 to .10 gives best results. More working Mg is required for heavier castings.

Highest ductility and strength are not obtained until structure is completely nodular. Physicals of 120,000 TS with 4 per cent elongation are common, but some flake graphite reduces physicals to 93,000 TS and 2 per cent elongation or lower with the same base iron.

As to type of furnace, Mr. Rehder recommends any furnace that will give the temperature efficiently. He said that temperature affects the recovery of Mg, recovery being lower at high temperatures. He recommends a tapping temperature of 2600° to 2700° Fahrenheit. Mg recovery also drops as Mg content of addition agent rises. He advises starting with 80 per cent Mg content of either Ni or Cu alloy and working down to a 50 per cent Mg content alloy.

Addition of the alloy causes violent flash, but it is not dangerous if dark glasses are worn. Alloy must never be forced below surface of metal. Use of a post inoculant adding .20 to .40 Si to metal coming from the furnace at about 2.40 Si is recommended. The metal must be carefully skimmed to remove impurities. This metal looks sluggish, but fluidity is good. A ½" section will run at 2300 F. Temperatures should be checked with a thermocouple, not a radiation pyrometer.

This material has little more pattern shrinkage than gray iron, but it has very great liquid shrinkage. It can be gated like gray iron, but must be risered as one would riser for steel castings to eliminate micro-shrinkage. Knock-off risers work well.

Mr. Rehder stated that this material is readily cut with the oxy-acetylene torch. To cut a 2" section, assume that it is a 3" section of steel.

Sections of ½" and under contain free carbides as cast and are brittle but anneal readily. Light sectioned castings are given a total anneal. They are held 13 hours at 1700 F to 1750 F then cooled to 1500 F., followed by slow cooling to 1250 F. Heavier castings are cooled slower, 1¼" sections 25° per hour compared to 120° per hour for light castings.

Mr. Rehder recommended use of the keel block test bar to produce a properly fed test bar. Fully annealed bars can give 60 to 70,000 lb psi tensile strength; 40 to 50,000 lb yield strength with 20 to 28 per cent elongation.

In the speaker's opinion, extensive use of this material depends on redesign to take advantage of its superior qualities. This can result in the customer getting a stronger product at a lower price, and the foundryman can sell his improved product at a favorable profit margin.

Tri-State

Dale Hall
Oklahoma Steel Castings Co., Inc.
Publicity Chairman

FEBRUARY 10, dinner meeting, held at the Spartan Cafeteria in Tulsa, featured J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala., as speaker.

Mr. Bowers covered several research reports conducted by his company. With the use of slides, the speaker pointed out the advantages and disadvantages of various melting practices.

Wm. W. Maloney, A.F.S. National Secretary-Treasurer, was a most welcome guest, and gave a short coffee talk on plans of the Society.

Michiana

J. P. Jordan
Dodge Mfg. Corp.
Chapter Secretary-Treasurer

GUEST SPEAKER at the March meeting was William Gude, Penton Publishing Co., Cleveland, who presented a talk on the foundry industry which proved of interest to both ferrous and non-ferrous foundrymen.

The entertainment committee provided a string quartet for dinner music. It was announced that our chapter has purchased a reprint of the A.F.S. film, "*Fluid Flow in Transparent Molds*." This film is now available and all rental arrangements will be handled by K. A. Nelson, Chicago Hardware Foundry Co., Elkhart, Ind.

Eastern New York

George E. Danner
American Locomotive Co.
Publicity Chairman

SPEAKING on "*Electronic Core Baking*" at the February meeting, held at the Circle Inn, Lathams, W. C. Rudd, Induction Heating Corp., New York, explained electronic core baking.

Describing tunnel line apparatus with conveyor system used in dielectric core baking, Mr. Rudd said that dielectric heating is generated by a vacuum tube set with a frequency of 15 million cycles per second. Heat is generated in the cores as they pass between the electrodes.

The entire core receives the same amount of energy with temperature rise being equal throughout the mass, regardless of cross-section. The cores are baked in this manner in an average time of two to four minutes.

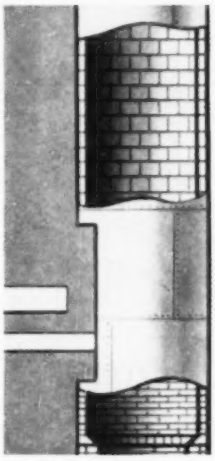
The main advantage of this method is the time element involved and the fact that cores cannot be overbaked. Secondly, cores made with this process show good dimensional stability.

Northern California

Milton Oakes
American Manganese Steel Co.
Chapter Reporter

MARCH MEETING's guest speaker was Hugo W. Heimke, California Alloy Products Co., Pasadena, who spoke on "*The Use of Castings in Welded Assemblies*." The meeting was held at the El Curtola restaurant, Oakland. Mr. Hiemke was well versed in his subject and presented an interesting and informative discussion, using slides to illustrate his talk.

MORE HEATS...MORE TONNAGE WITH



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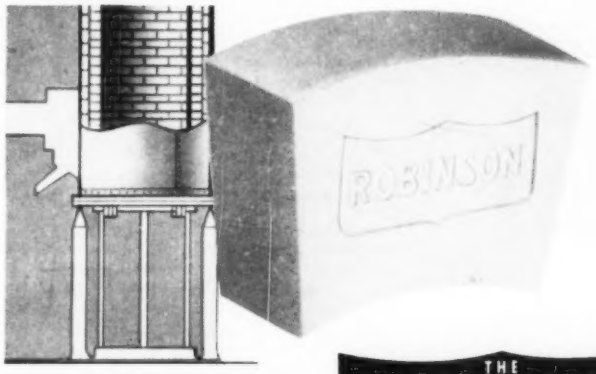

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BOOK REVIEWS

Tool Engineers Handbook

Tool Engineers Handbook, First Edition, compiled by American Society of Tool Engineers Handbook Committee. 2070 pp. Illustrated with charts, graphs and drawings. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. $15. (1949).

This monumental work, requiring eight years and the work of 144 authorities to compile, covers the whole field of manufacturing industries and the processes they employ to fabricate raw materials into finished products. This one volume contains definitions, procedures, tables, equations, charts and symbols gathered from the work of some 18,000 ASTE members.

Designed to present detailed data to the highly-specialized tool engineer, this reference work also serves as a source of information for non-engineering industrial management.

Classified under 12 major headings, the *Tool Engineers Handbook* contains technical data and specifications for production planning and control, materials and machinability; casting and extruding; metal cutting, grinding and finishing; metal forming; welding, gluing and mechanical joining of materials; surface finish and protective coatings; peening and balancing; gaging, inspecting and testing; tool design; machine controls and feeding devices; design of threads, gears, bearings, etc.; and mathematics, physics and reference tables.

Chemistry-Physics Handbook

Handbook of Chemistry and Physics, 31st Edition, edited by Charles D. Hodgman. 2756 pp. 4½ x 7 in. $6. (1949).

Now in its 31st Edition, *Handbook of Chemistry and Physics* is compiled in five sections and contains complete mathematical tables; properties and physical constants of the elements; properties of organic and inorganic compounds; chemical tables; tables of specific gravity; properties of matter; heat and hygrometry; sound; electricity and magnetism; light; conversion tables and other data.

New material in the 31st Edition includes a table of logarithms of decimal fractions; a table of squares of the Sine and Cosine and their product, and the former table of arrangement of electrons in orbits has been replaced by a table of electronic configuration of the elements. Other additions are a table of isotopic masses and a table of wave lengths of principal lines in emission spectra of elements. Revisions and new material in the 31st Edition total 180 pages.

Training Films

Training Film Annual. 64 pp. Published by Commercial Films, Inc., Post Office Box 7, Cleveland 21, Ohio. $1. (1949).

Containing 327 programs and 355 illustrations, this training film annual represents the most complete catalog of training sound slidefilms ever compiled. Running

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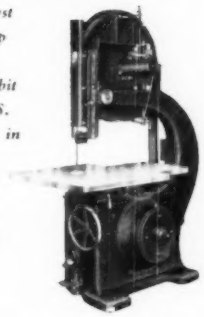

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time, number of frames and a complete resume are given for each of the 327 training programs outlined in this volume. Contents and listings are arranged by general subject matter, i.e., commercial, industrial, school and church films.

Preparations, projection and showmanship in use of training slidefilms are breifly outlined.

Replacing Equipment

Dynamic Equipment Policy, by George Terborgh. 290 pp. Charts and diagrams. Published by McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18. $3.75. (1949).

Written by the research director of the Machinery and Applied Products Institute, Dynamic Equipment Policy discusses the principles of sound re-equipment analysis and shows practical procedures for their application. Depreciation of capital equipment is explained and rules for replacing it are outlined. Replacement procedures illustrated in the book are taken from the experiences of many industrial organizations. Popular rule-of-thumb methods for replacing capital equipment are analyzed and appraised in the light of their value to industry.

Cast Iron Mixtures

Miscele di Ghisa Nella Moderna Fonderia (Cast Iron Mixtures in the Modern Foundry), by Mario Olivo, Impiante Fonderie Olivo, Milan, Italy. Published in Italian by Ulrico Hoepli, Milan, Italy. 242 pp. Paperbound.

Designed to enable the Italian foundryman to make the best use of the ferrous casting raw materials found in Italy, this volume covers materials used in casting machinery and parts in virtually all major industries. Its author is president of the Italian Foundrymen's Association and the Italian Foundry Equipment Manufacturers' Association.

Industrial Time Study

The Fatigue Allowance in Industrial Time Study, by Matthew A. Payne. 66 pp. Published by Matthew A. Payne, 13777 Euclid Ave., Cleveland 12, Ohio. $2.50. (1949).

This booklet presents a practical analysis of problems dealing with the purpose, determination and application of the fatigue allowance in industrial time study and contains examples and opinions concerning the effect of fatigue allowances on workloads, manpower and incentive assignments. Containing 65 quotations and 85 references, *The Fatigue Allowance in Industrial Time Study* is the published result of three years' research.

Transfer French Foundry Technical Center Offices

Offices of the Centre Technique des Industries de la Fonderie are now located at 12 Avenue Raphael, Paris 16, France. For the present, the chemistry and physics laboratories and standardization office remain at 46 Avenue Victor Hugo, while the sand, surface conditions, and domestic heating apparatus office continues at Sevres 44 Avenue de la Division Leclerc.

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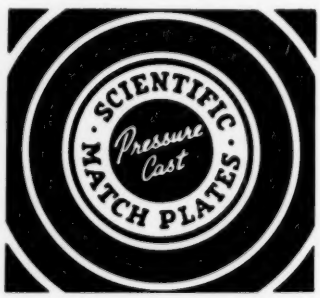

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PERSONALITIES

(Continued from Page 161)

named executive vice-president of that organization. Both American Steel & Wire and Carnegie Illinois are subsidiaries of United States Steel.

G. Caspar Haas, formerly with the Wilhelm Engineering Co., Webster City, Iowa, has been named head of the Permanent Mold Department of Fairfield Metal Products, Inc., Fairfield, Iowa, manufacturers of aluminum sand and permanent mold castings.

Ernest E. Brayshaw, formerly works manager for Southwest Steel Rolling Mills, Los Angeles, recently became affiliated with Continental Foundry & Machine Co., in a sales capacity connected with the firm's rolling mill and heavy machinery products. Mr. Brayshaw was for 11 years assistant division superintendent for the Carnegie-Illinois Steel Corp.'s Clairton Works.

B. Armenian, owner of the foundry of that name at Choubrah El Kheima, Egypt (near Cairo), recently completed a six-week visit to Chicago, Cleveland, Milwaukee and Birmingham, where he studied foundry techniques and contacted equipment manufacturers. His plant—which includes a machine shop and enameling shop—produces sanitary ware, pipe and fittings, pouring about 20 tons a day. Mr. Armenian is mechanizing his shop on a small scale to produce better and more standardized castings.

Robert E. Savage, who has been research associate under Prof. Howard F. Taylor at the Massachusetts Institute of Technology since receiving his D.Sc. from that institution last September, has joined the Ductile Iron Section, Development & Research Division, International Nickel Co., New York. A graduate of Rensselaer Polytechnic Institute in 1943, Mr. Savage spent three years in the Naval Reserve before attending MIT for his master's and doctor's degrees. He will present technical papers at the forthcoming 51th A.F.S. Foundry Congress & Show in collaboration with Dr. Howard K. Taylor of MIT.

John W. Goodwyn, a recent graduate of Tulane University, has been appointed sales representative for the United States Graphite Co., Saginaw, Mich., and will establish headquarters in Chattanooga, Tenn. In addition to Chattanooga and parts of Tennessee and North Carolina, Mr. Goodwyn's territory will include Alabama, South Carolina, Georgia and Florida.

R. O. Blackford of 1336 Calvin St., S. E., Grand Rapids, Mich., has been appointed Grand Rapids district representative for the Buckingham Products Co.'s line of polishing and buffing compositions and foundry supplies.

John R. Wark, chairman of the A.F.S. Western New York Chapter, recently resigned his position as sales manager for the Queen City Sand & Supply Co., Buffalo, to establish Wark Foundry Services, Inc., in Kenmore, N. Y. Mr. Wark joined the E. J. Woodison Co., Buffalo, in 1923 as a salesman and succeeding his father as manager of that organization upon his father's death in 1936. He has been with Queen City in charge of foundry supplies and equipment sales since 1938, with the exception of three years' service as a Naval gunnery officer in the Pacific during World War II. Mr. Wark was instrumental in forming Western New York Chapter, serving as first secretary, later director and vice-chairman and is today chairman. A noted rifle shot, Mr. Wark holds three world's records and in 1939 was selected a member of the U. S. International Pershing Rifle Team.

Robert E. Cope has been named general manager of the newly-expanded Permanent Molding Division of the Michigan Wheel Co., Grand Rapids, Mich. Mr. Cope, a graduate in metallurgical engineering from the University of Michigan, was formerly product engineer for Aluminum Co. of America, and plant manager for the Aluminum Permanent Mold Co. Mr. Cope's Division will manufacture permanent mold castings in bronze and aluminum and provide complete pattern, casting, finishing and machining services.

Donald K. Rennie has been named works manager of the American Brakeblok Div., American Brake Shoe Co., and James W. Green, Jr., has been appointed superintendent of Brakeblok's Winchester, Va., plant, succeeding Mr. Rennie. Mr. Rennie, who has been with Brake Shoe since 1938, will be located in Detroit. His successor, Mr. Green, has been with Brake Shoe since 1947 and prior to that saw service as a paratrooper Captain in the Aleutian and European theaters of operation. He is a graduate of Virginia Polytechnic Institute.

Three executive promotions announced by the Carborundum Co., Niagara Falls, N. Y., are: **Ernest R. Baxter,** former director of sales and sales administration to assistant vice-president; **Frederick W. Bonacker,** sales manager of Coated Products Div., to general sales manager of the company; and **Fred W. Scott, Jr.,** from assistant sales manager to sales manager of the Coated Products Division. Mr. Baxter, who joined the company in 1919, in his new capacity will advise and consult all offices of the sales department. Mr. Bonacker, as new sales manager of the company, will have charge of all U. S. and Canadian field sales operations, sales administration, commercial research and merchandising. Mr. Scott, as Coated Products Division sales manager, will direct that Division's sales, sales engineering, retail sales and sales service operations.

Newly-elected members of the Board of Directors of the Canadian Car & Foundry Co., Ltd., Montreal, are: **J. Alex Prud'homme,** partner in the Montreal law firm of Goeffrion and Prud'homme; **R. C. Berkinshaw,** vice-president and general manager of the Goodyear Tire & Rubber Co. of Canada; and **R. C. Vaughan,** retired

president and chairman of the Board of Directors of Canadian National Railways.

Meeting February 14, the Quarter Century Club of the **Whiting Corp.**, Harvey, Ill., held its annual business meeting and election of officers at the Del Prado Hotel, Chicago. New officers are Arthur D. Corley, president; Doyle Sweet, Sr., vice-president; James Munro, Sr., Al Westerholm, W. Guy Roy and Charles A. Geupel, directors; Alfred Hess, treasurer; and Mary Mockton, secretary.

G. R. Meyers, for 23 manager of the Core Oil, Paint and Varnish Division of Penola, Inc., New York, has been elected a director of the company. Mr. Meyers maintains his offices at Penola's Midwest sales office in Detroit.

Walter Bonsack

Walter Bonsack, formerly director of Laboratories for the Apex Smelting & Refining Co., Cleveland, has resigned to accept a position as vice-president and director of research for the Christiansen Corp., Chicago. Born and educated in Berlin, Germany, Mr. Bonsack came to this country in 1927, and has since been prominent in technical activities of the American Foundrymen's Society and of other metals technical organizations. A past chairman of the A.F.S. Aluminum and Magnesium Division, Mr. Bonsack is a frequent speaker before A.F.S. meetings and has written many articles for the metals industry trade and technical press.

Alex J. Juroff, formerly foundry metallurgist for Bendix Products Division, South Bend, Ind., has been named plant manager for Duramold Castings, Inc., Mishawaka, Ind. A graduate of Michigan State College, Mr. Juroff was a member of the faculty of that institution from 1936 to 1940. He is a member of the A.F.S. Sand Castings Committee of the Aluminum and Magnesium Division.

Ronald E. Turner has been appointed sales manager of the Queen City Sand & Supply Co., Buffalo, N. Y., succeeding his father, the late J. Ralph Turner. Mr. Turner is a graduate of Rensselaer Polytechnic Institute.

Robert E. Savage and **Ralph W. White** have joined the Magnesium Containing Cast Iron Section of the Development and

(Continued on Page 185)

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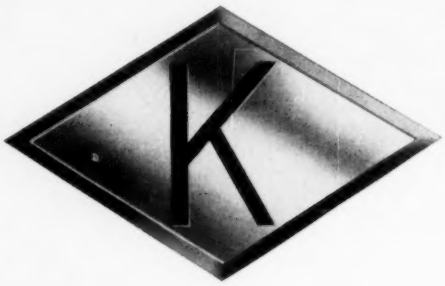

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PERSONALITIES

(Continued from Page 183)

Research Division of the International Nickel Co., New York. Mr. Savage, who holds a D. Sc. from the Massachusetts Institute of Technology, was formerly sand supervisor for Pittsburgh Steel Foundry Corp. Mr. White, who holds a bachelor of science degree from Grove City College in metallurgical engineering, was formerly with the Cooper-Bessemer Corp. as foundry engineer, and more recently was superintendent for the E. W. Bliss Co., Toledo, Ohio.

OBITUARIES

Col. William W. Rose, 66, former executive vice-president of the Gray Iron Founders' Society, Cleveland, died February 20 at the U. S. Marine Hospital in Baltimore, Md., following a prolonged illness. Col. Rose, who was buried in Arlington Cemetery with full military honors, was a graduate of West Point and served in France during World War I as a unit commander, winning the Purple Heart and Distinguished Service Medals. In 1919, he joined the foreign service department of the Bethlehem Steel Corp. as representative in Brazil. In 1934, Colonel Rose was appointed deputy administrator for the National Recovery Act and was largely responsible for developing its gray iron foundry code. Following termination of NRA, Colonel Rose was appointed executive vice-president of the Gray Iron Founders' Society, serving as executive head of the Gray Iron Founders' Society until his retirement in 1946.

Alexander Murdoch, 58, superintendent of the Birmingham, Ala., plant of the American Brake Shoe Co., died February 17 in a fall from the third floor of the Brake Shoe building. A native of Scotland, Mr. Murdoch had been an employee of the company for more than 15 years.

Henry R. Robinson, former president of Swayne, Robinson & Co., Richmond, Ind., died January 24 following a prolonged illness. A grandson of the company's founder, Mr. Robinson began work with Swayne, Robinson & Co. as a workman, advancing through various executive positions to the presidency in 1933.

Louis A. Cohn, 69, president and founder of L. A. Cohn & Brother Co., Cicero, Ill., died February 28 in Wesley Memorial Hospital, Chicago. One of the original members of the Brass and Bronze Ingot Institute, Mr. Cohn, formed L. A. Cohn & Brother, Inc., in 1905.

John Buck, 59, assistant works manager of the Scullin Steel Co., St. Louis, died February 9 of a heart attack at his home in St. Louis. Mr. Buck had been an employee of Scullin Steel for 40 years, serving in various capacities in the company's mechanical department until 10 years ago, when he was appointed assistant works manager in charge of the machine shop and maintenance department of the company.

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ABSTRACTS OF TECHNICAL ARTICLES

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Cast Iron Properties

21—HARDNESS A POOR INDICATION. Jean Gélain, "The Relationship between the Hardness and the Other Mechanical Properties of Cast Iron," *Fonderie*, Dec. 1949, pp. 1873-1875 (in French).

The author points out that the linear relationship between hardness and the tensile strength which is valid for steels having up to one per cent carbon does not hold true for cast irons. Graphs taken from different sources illustrate this point. It is clearly shown that deviations as large as 30 per cent exist between the tensile strengths of different cast irons of the same hardness.

Redesign For Casting

22—ACHIEVE SIMPLICITY AND INTERCHANGEABILITY. "Redesign from Wood to Die Castings," *Die Castings*, vol. 8, Jan. 1950, pp. 28-30, 55-57.

The new Executone has been redesigned from wood to die castings because of the uniformity and interchangeability of die cast parts. The system can be enlarged by simply replacing the front grille and hooking in additional stations as they are needed. The use of die cast parts has resulted in simplified assembly methods, thin uniform walls and a minimum of machining.

Nodular Iron Service Data

23—CHEMICAL AND MECHANICAL PROPERTIES. C. R. Austin, "Some Engineering Aspects of Nodular Cast Iron," *Iron Age*, vol. 164, Dec. 1, 1949, pp. 79-85.

A few engineering aspects of the Meehanite nodular irons are discussed along with some examples of the pearlite nodular castings which are being placed in service to obtain data. Microstructures illustrating the difference between ferritic and pearlitic nodular irons are shown. Also included are many microstructures of brake shoe sections. Several tables giving the chemical and mechanical properties of typical Meehanite nodular castings produced for service tests are included.

Steel Carburization

24—USE OF ALKALI CARBONATES. Josef Doskar, "Influence of Certain Additions on the Speed of Carburization of Steels by Charcoal in the Cementation Process," *Hutnické Listy*, vol. 4, Dec. 1949, pp. 389-391 (in Czech).

It is shown that by soaking the charcoal used in carburization of steels in a solution of sodium, potassium, or lithium carbonates, the speed of penetration of carbon and the carbon content in the carburized layer are increased; no corrosive action was observed. Further experiments showed similar properties of mixtures of barium and sodium salts, and of mixtures of beryllium and sodium and of cobalt and sodium compounds.

Melting Procedures

25—FURNACE CHARACTERISTICS. R. A. Colton, "Melting Practice for Copper-Base Alloys," *The Foundry*, vol. 78, Jan. 1950, pp. 56-57, 111, 114.

Standard practices which produce consistently good castings are described to help foundries getting variable results. The furnaces used in melting the alloys are mentioned. In gas or oil fired equipment, the combustion products contain a large amount of water vapor which may cause porosity in castings. The coke and electric type furnaces give the least trouble. There are no products of combustion with electric melting and very little water vapor is produced with coke. The recommended melting practices of the following alloys are described: tin and leaded tin bronzes, silicon and aluminum bronzes, manganese bronzes, yellow brasses, and nickel silver alloys.

Producing Acicular Iron

26—DEVELOPMENT OF SPECIAL IRONS. Lennart Bernstein, "Acicular Cast Iron," *Gjuteriet*, vol. 40, Jan. 1950, pp. 1-7 (in Swedish).

The author briefly reviews the development of gray cast iron from ordinary more or less ferritic irons to the modern high strength pearlitic ones. The transformations which occur in the matrix when regular gray iron without alloys cools to room temperature are discussed. The production of acicular cast iron through heat treatment of iron without alloys or of low alloy content is described. The author discusses the influence of molybdenum and nickel on the transformation of the cast iron matrix and shows how an acicular structure can be obtained by means of a suitable combination of these two alloys. The influence of other elements in the iron is touched upon and data are given on the properties obtained and on suitable applications.

Underground Castings

27—LOST WAX PROCESS. K. J. Yonker and J. F. Henderson, "Drilling for Oil with Large Precision Castings," *Iron Age*, vol. 165, Feb. 2, 1950, pp. 75-78.

The making of rotors and stators for the turbodrill weighing respectively 8 and 12 lb as-cast, by the lost wax precision casting process, is described. To insure filling out of the blades pouring temperatures of approximately 2700 F for the rotors and 2900 F for the stators were necessary. Heavy risers were used to feed the hubs. Powdered graphite was added to risers immediately after pouring, thus raising the carbon content of the metal. This lowered the freezing point of the risers and kept them fluid and open for a longer period of time.

Foundry Mechanization

28—PRODUCTION TRIPLED. Pat Dwyer, "Mechanized Foundry Makes Farm Implement Castings," *The Foundry*, vol. 78, Jan. 1950, pp. 66-69, 152, 154.

The foundry of the Ohio Cultivator Division, National Farm Machinery Cooperative Inc., Bellevue, Ohio, recently mechanized its foundry. By introducing mechanical equipment in the melting, sand preparation and distribution, molding, casting and cleaning departments, production was approximately tripled. Metal for the castings is melted in twin cupolas, each cupola being operated on alternate days. The stockyard is served by a gantry type crane.

Organic Sand Binders

29—CORE CASES. W. M. Lord, "Foundry Cores and Molds"—Vapours and Fumes Evolved from Organic Bonding Materials," *Iron and Steel*, vol. 23, Jan. 1950, pp. 21-25.

Some of the substances which may be produced by the thermal decomposition of organic sand binders are described so far as this information is available in the published literature. The main headings covered are: fumes evolved during mixing and use on the bench, volatile substances evaporated during the baking process, fumes produced during the baking process, volatile products from other binding agents, fumes evolved after baking and after pouring, and future research. Following are some of the fumes evolved: water vapor, formic acid, acetic acid, carbon monoxide, pyrocatechin, butyric acid, carbon dioxide, furfuraldehyde, and propionic, acrolein, and pelargonic acid.

Heavy Floor Molding

30—CEMENT BONDED SAND. "Casting Turbine Wheels in One Piece for Hydro-Electric Generators," *Fonderie*, Dec. 1949, pp. 1869-1872 (in French).

The molding and pouring of two large turbine wheels, almost 18 ft in diameter and weighing 42 tons after machining, are described. The molding sand used had the following proportions by weight: 95 sand, 5 cement, and 5 water. On some surfaces ½ to 1 in. of excess material was provided to take care of shrinkage and machining.

Nodular Iron Developments

31—EFFECTS OF COMPOSITION. Donald J. Reese, "Factors Affecting Development of

Ductile Iron," *The Foundry*, vol. 78, Jan. 1950, pp. 58-62, 216-217.

Latest developments in the production of ferritic and pearlitic types of ductile irons are presented. The effects of sulfur, phosphorus, silicon, carbon, and manganese in irons are described and the results obtained by introducing small quantities of magnesium to the iron is briefly mentioned. Range of mechanical properties reported for ductile irons is: elongation as-cast, 3-20 per cent; tensile strength as-cast, 70,000-120,000 psi; modulus of elasticity, approximately 25,000,000.

Aircraft Bearings

32—High Load Linings. Josef Valter, "Lead Bronze as a Bearing Alloy," *Hutnické Listy*, vol. 4, Dec. 1949, pp. 381-386 (in Czech).

The good qualities of lead-bronze bearing linings are pointed out. In the modern practice the tendency is toward thin steel casings lined with lead bronze for higher loads and durability, as in aircraft engines of 2,000 HP and above.

Gray Iron Production

33—Process Survey. R. L. Collier, "Production of Gray Iron Castings," *Steel*, vol. 120, Jan. 23, 1950, pp. 64-76.

The various characteristics and general composition of gray iron are discussed along with how it differs from chilled iron and malleable iron. The process of making gray iron castings is described beginning with the melting operation through cleaning and inspection operations. The use of green and dry sand molds is briefly discussed and a description of the permanent mold process is given. Some of the engineering properties of gray iron are mentioned such as, heat resistance, damping capacity, good machinability, and antifriction properties. The recent development of nodular iron in the as-cast state by the use of cerium or magnesium is briefly mentioned.

Precision Investment Casting

34—Operating Details. Hiram Brown, "Modern Practice in Investment Casting," *The Foundry*, vol. 77, Nov. 1949, pp. 82-83, 205-212; vol. 77, Dec. 1949, pp. 93, 241-248; vol. 78, Jan. 1950, pp. 74-78, 182.

A complete discussion of the investment casting process is given in three installments. Subjects discussed are, the properties of pattern and investment materials, preparation of investments, readying the mold, gating practice, melting and pouring, and the effect of mold temperature and metal temperature on the mechanical properties of castings.

Hydrogen In Steel

35—Susceptibility. F. Kinsky, "Flaking in Steel," *Hutnické Listy*, vol. 4, July, 1949, pp. 201-210; Aug., 1949, pp. 241-246; Sept., 1949, pp. 277-284 (in Czech).

Although generally adopted, the hydrogen theory of flakiness does not provide the practical metallurgist with any precise methods for the prevention of the formation of flakes. However, in the author's opinion, such methods could be formulated, at least in certain cases, so that the

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American Foundryman

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arbitrariness in basic steel production could be reduced. In this case, it is up to the steelmaker to decide on the kind of steel requiring the use of the regulated cooling process, as the steels, even with equal hydrogen contents are not equally susceptible to flaking. In the case of acid steels, the hydrogen content is at its lowest, but even here flakes can occur. Attempts to reduce the hydrogen content in steels below a critical limit of flakiness have, as yet, proved unsuccessful. However, the steel can be conditioned for hydrogen diffusion that will serve the purpose of preventing cracks from arising.

Malleable Annealing

36—TYPES OF FURNACES. C. H. Martin and H. J. Hammond, "Development of Furnaces for Malleable Iron Annealing," *The Foundry*, vol. 78, Jan. 1950, pp. 80-82, 209-213.

The malleable annealing process is described along with the operation of typical equipment currently employed in malleable iron foundries. The speed of the malleabilizing treatment depends on the analysis of the iron, the design of the annealing equipment, and the size and shape of the castings. Metallurgical research has developed fast-annealing, high-silicon irons which, with modern furnace designs will complete a malleabilizing treatment in as little as 14 hr. Formerly this required 4 to 10 days. The cost of malleabilizing has been greatly reduced by utilizing automatic handling devices and the use of protective atmospheres in the furnace. The latter has eliminated the need of massive pots to cover the castings.

Casting Magnet Alloys

37—PROCESS AND PROPERTIES. Thomas A. Dickinson, "Casting Alloys for Permanent Magnets," *Steel*, vol. 126, Jan. 9, 1950, pp. 48-51.

The materials and most common methods used in the making of permanent magnets are described. A coarse granular structure with a strained crystal lattice is most desired in the cast material because it permits a strong magnetic field to be retained for a long time. The Alnico magnet alloys and their physical properties and many of the ferrous and non-ferrous magnetic materials are given in tables.

Reading Foundrymen Hear Lee On Employee Relations

APPROXIMATELY 125 MEMBERS of the Reading Foundrymen's Association met February 22 at the Berkshire Hotel, Reading, Pa., to hear Ralph L. Lee, General Motors Corp., in a discussion of "*Man to Man on the Job.*"

Mr. Lee stressed the need for knowledge of human behavior in the development of technical programs in business. "Individuals take pride in their differences," the speaker said, "and one of the employer's duties is to know his employees' characters and abilities."

Paul B. Harner, past president of the Association, introduced the speaker.

A. F. S. Employment Service

To contact "Help Wanted" or "Position Wanted" advertisers, write to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, designating item number and issue of AMERICAN FOUNDRYMAN in which advertisement is published.

In replying to "Help Wanted" advertisements, please furnish resumé of experience, education and other pertinent qualifications. Data will then be forwarded to advertiser for direct reply.

HELP WANTED

HW520—Aluminum Foundryman: Reliable 50 year old firm located in Middle West interested in contacting foundryman experienced in all phases heat treated cast aluminum production. Prospective contract will require man capable of handling relatively small operation. Please give qualifications, references, salary expected and other pertinent data.

HW522—Iron Foundryman Opportunity: To strengthen top management due to contemplated retirements, there is an excellent job opportunity for a young "mature" tip-top experienced, practical foundryman in a nationally known, well established, progressive jobbing and semi-production foundry in Ohio. Plant currently employs 225 persons (war peak 600) producing exceptionally high quality light and medium iron castings in a wide variety of specification irons. Castings weigh from less than an ounce each to generally not over 500 lb each and sections vary from a scant ¼ in. to 4 to 6 in. Deliveries are not limited to a local community market, but a variety of different industries are served throughout Ohio and the eastern states.

Applicant must have no concern for job title. The proper person can help carve his own permanent future, if he can successfully handle all foundry operations and departments. Company realizes some months will be required for proper person to become acquainted with present personnel, various types and nature of production, and unusually high quality casting standards.

Applicant must have good previous experience and employment record. Must be able to handle men. Must be of a caliber to work harmoniously with present supervisory force, which he is to supplement, and to observe and learn from present qualified, experienced, and practical top personnel now carrying on very well. He must be able to instruct and train engineering graduates who are being built into a larger supervisory and executive organization to prepare for greater production.

Give detailed resumé of personal history, education, training, past, and present connections, earnings, and photograph (all of which will be kept confidential) in first letter, for from it a decision will be made as to whether applicant will be invited for a personal interview to the company's plant at company expense.

HW523—Maintenance Supervisor: Preferably with engineering degree, for 100 molder gray iron foundry. Preventive maintenance program important. Should have experience in maintenance and repair work in all departments. Give personal resume covering fully: education, past and present responsibilities, earnings, and photograph. All information held confidential.

HW524—Core Department Supervisor: Must be fully qualified to handle entire department employing 25 to 75 men making, preparing, and assembling cores for gray iron foundry. Must know mixes and finishes for all types of cores from machine tools to light diesel engine cylinders and heads. Must know how to make cores on bench, machine, and blower, and be able to prepare and assemble intricate cores. Must operate core department generally for convenience of foundry departments. Job requirements are high. Practical knowledge and ability to work with people essential.

Application must include full details of training, previous and present employers, earnings, and photograph. Information strictly confidential.

HW525—Salesman: Want young man with pattern shop or core room experience to travel extensively on demonstration and sales of new core room specialty. Technical training and attractive personality desirable.

HW526—Time Study Man: Manufacturer of valves and fittings in upstate New York has opening in time study. Produce and machine gray iron, malleable, and non-ferrous castings. Unusual opportunity. Write, stating qualifications fully, including age, experience, past positions, and salary expected.

HW527—Foundryman or Foundry Engineer: Need man not more than 50 years old with practical experience in foundry and college degree in metallurgy. Experience in manufacture of alloy iron castings up to 60 tons particularly desired. Must have technical as well as practical background. Fine opportunity with nationally known and established firm for man of required capabilities.

POSITIONS WANTED

PW125—Iron/Steel Foundry Manager: 17 years experience in foundry and metallurgical development work. Excellent experience history. Top flight iron and steel foundry background, thoroughly capable of assuming executive responsibility. M. S. in metallurgy; have written technical papers. U.S. citizen. Salary $15,000 plus efficiency bonus.

PW131—Chief Metallurgist: Fourteen years exceptional experience in ferrous and non ferrous metallurgy, including all phases of foundry practice, melting, alloying, heat treatment, testing quality control—of iron, aluminum, magnesium, and copper alloys. Installed and supervised complete metallurgical control laboratories; done trouble shooting and consulting work. Employed in responsible administrative position but desire change. Age 38.

PW134—Industrial Engineer/Consultant: Have thorough knowledge and background in latest foundry practices, improved pattern and core box design, development of present and new equipment for better operations. Will consider any Western inquiries.

PW135—Metallurgical Engineer: Have two years steel foundry experience, am 27 years old. Familiar with physical, chemical, and sand control, as well as metallurgical sales specifications, heat treating, and general foundry operations. Desire position in the South or Southwest.

PW136—Core Room Supervisor/Troubleshooter: Well versed in all phases of foundry operation. Age 45. Have 26 years practical experience including 7 years supervision of core room in foundry producing gas and diesel cylinder heads and water cooled manifolds in dry and green sand. Cost minded, capable of assuming responsibilities; excellent references. Available now to progressive foundry.

PW137—Metallurgical engineer: College graduate with 14 years experience in light metal and non-ferrous foundries, including sand, permanent mold, die, plaster, and investment casting. Capable writer and speaker. Outstanding record includes executive and technical experience.

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• THE BUYERS' GUIDE •

As a service to A.F.S. Members and those who use Society media for promoting the usefulness of their products in the Foundry Industry, current AMERICAN FOUNDRYMAN Advertisers, and Exhibitors at the 1950 Foundry Show are presented in the Official Convention Issues Buyers' Guide.

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Charles E. Roland, 215 Forest Drive, Itasca, Ill.
Salem Engineering Co., 714 S. Broadway, Salem, Ohio.
Sorbo-Mat Process Engineers, 3938 Lindell Blvd., St. Louis 8.
Earl E. Woodliff, 14611 Fenkell, Detroit 27.

Converters • Side Blow

Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Conveying and Materials Handling Equipment

Ajax Flexible Coupling Co., Inc., English & Portage Sts., Westfield, N. Y.
C. O. Bartlett & Snow Company, 6200 Harvard Avenue, Cleveland.
Butler Bin Co., Carscoop Div., Waukesha, Wis.
Chain Belt Co., 1725 West Bruce Street, Milwaukee 4.
Foundry Equipment Co., 1831 Columbus Rd. N. W., Cleveland.
Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Kwik-Mix Co., c/o Koehring Co., 3026 W. Concordia, Milwaukee.
Link-Belt Co., 300 W. Pershing Rd., Chicago
Mathews Conveyors Co., Ellwood City, Pa.
Modern Equipment Co., 360 S. Spring St., Port Washington, Wis.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Newaygo Engineering Co., Newaygo, Mich.
Ready-Power Co., 3826 Grand River Ave., Detroit.
Robins Conveyors Div., Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.
Standard Conveyor Co., 315 N. W. Second St., North St. Paul 9, Minn.
Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.
Syntron Co., 545 Lexington, Homer City, Pa.
Towmotor Corp., 1226 E. 152nd St., Cleveland.
Union Steel Products Co., Albion, Mich.
Whiting Corp., Harvey, Ill.

Core and Mold Washes

Borden Co., Chemical Div., 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
Foundry Services, Inc., 280 Madison Ave., New York 16.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Hougland & Hardy—Hardy Sand Co., 507 S. E. 2nd St., Evansville, Ind.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
S. Obermayer Co., 2563 West 18th Street, Chicago 8.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 North Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Pa.
Whitehead Bros. Co., 324 W. 23rd St., New York 11.

Core Binders, Oils and Compounds

American Cyanamid Co., Plastics Dept., 30 Rockefeller Plaza, New York 20.
Bakelite Div., Union Carbide & Carbon Corp., 300 Madison Ave., New York 17.
Black Products Co., 13513 Calumet Ave., Chicago.
Borden Co., Chemical Div., 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Corn Products Sales Co., 17 Battery Place, New York 4.
Dayton Oil Co., 1201 E. Monument Ave., Dayton, Ohio.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.

Foundry Service Co., 2321-29—29th Ave. N., Birmingham, Ala.
Hercules Powder Co., 912 Market St., Wilmington, Del.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33.
Chas. A. Krause Milling Co., Milwaukee.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
Monsanto Chemical Co., St. Louis.
S. Obermayer Co., 2563 West 18th Street, Chicago 8.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Philadelphia.
Penola Inc., 3780 Penobscot Bldg., Detroit 26.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Werner G. Smith Co., 2191 West 110th Street, Cleveland 2.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 North Summit St., Akron, Ohio.
Swan-Finch Oil Corp., RCA Bldg., West, New York 20.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Pa.
Velsicol Corp., 330 E. Grand Ave., Chicago.

Core Blowers and Supplies

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Wm. Demmler & Bros., Kewanee, Ill.
Eastern Clay Products, Inc., Jackson, Ohio.
Federal Foundry Supply Co., 4690 E. 71st St., Cleveland 5.
Foundry Service Co., 2321-29—29th Ave. N., Birmingham, Ala.
Harrison Machine Co., 2725 Station Rd., Box 67, Wesleyville, Pa.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
The Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
Redford Iron & Equipment Co., 20733 Glendale, Detroit 23.
SPO Inc., 7500 Grand Division Ave., Cleveland 25.

Core Grinders

Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
SPO Inc., 7500 Grand Division Ave., Cleveland 25.

Core Knockout Equipment

Cleco Div. of Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13.
Dayton Pneumatic Tool Co., 8-10 Norwood Ave., Dayton, Ohio.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Pangborn Corp., Hagerstown, Md.

Core Making Machines

British Moulding Machine Co. Ltd., Weston Works, Faversham, Kent, England.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
SPO Inc., 7500 Grand Division Ave., Cleveland 25.
Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.
Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35.

Core Ovens

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Girdler Corp., Thermex Div., 224 E. Broadway, Louisville 1, Ky.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
J. O. Ross Engineering Corp., 350 Madison Ave., New York 17.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Core Paste

Black Products Co., 13513 Calumet Ave., Chicago.
Borden Co., Chemical Division, 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Eastern Clay Products, Inc., Jackson, Ohio.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Foundry Services, Inc., 280 Madison Ave., New York 16.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
S. Obermayer Co., 2563 W. 18th St., Chicago 8.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
Whitehead Brothers Co., 324 W. 23rd Street, New York 11.

Core Plates

Black, Sivalls & Bryson, Inc., Power & Light Bldg., Kansas City, Mo.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Industrial Fabricating, Inc., 817 Hall, Eaton Rapids, Mich.
K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14.

Core Racks

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Industrial Fabricating, Inc., 817 Hall, Eaton Rapids, Mich.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.

Core Rod Straighteners and Shearing Machinery

American Wheelabrator & Equipment Corp., 630 S. Byrkit St., Mishawaka, Ind.
Economy Tool & Machine Co., 1732 Glade St., Muskegon, Mich.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.

Core Sand Reclamation Equipment

Frank G. Hough Co., Libertyville, Ill.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Nichols Engineering & Research Corp., 70 Pine St., New York 5.

Core Vents

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
The PMS Co., 1071 Power Ave., Cleveland 14.
United Compound Co., Inc., 328 S. Park Ave., Buffalo 4.

Core Washes

Asbury Graphite Mills, Inc., Asbury, N. J.
Black Products Co., 13513 Calumet Ave., Chicago.
Borden Co., Chemical Div., 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Federal Foundry Supply Co., 4690 E. 71st St., Cleveland 5.
Foundry Services, Inc., 280 Madison Ave., New York 16.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Lava Crucible Co. of Pittsburgh, 627 Wabash Bldg., Pittsburgh.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
Ottawa Silica Co., Box 437, Ottawa, Ill.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.

Couplings • Flexible

Chain Belt Co., 1725 W. Bruce St., Milwaukee 4.

Cranes • Overhead and Tractor

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Crucibles

American Crucible Co., Washington Ave., North Haven, Conn.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Jos. Dixon Crucible Co., Jersey City 3.
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo, N. Y.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.
Vesuvius Crucible Co., P. O. Box 8275, Swissvale, Pittsburgh 18.

Cupolas

Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Cupola Blowers

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.
Spencer Turbine Co., 486 New Park Ave., Hartford 6, Conn.

Cupola Chargers

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Frank G. Hough Co., Sunnyside Ave., Libertyville, Ill.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., Harvey, Ill.

Cupola Control Equipment

Foxboro Co., Neponset Ave., Foxboro, Mass.

Cupola Lighters

Whiting Corp., Harvey, Ill.

Cutoff Machines

Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35.

Die Casting Machines

DCMT Sales Corp., 164 Duane St., New York 13.

Dust Collecting Equipment • Dry

Aerodyne Development Corp., 2424 Euclid Ave., Cleveland 15.
Alloy Metal Abrasive Co., 311 West Huron Street, Ann Arbor, Mich.
American Air Filter Co., Inc., 104 Central Ave., Louisville 8.
American Wheelabrator & Equipment Corp., 630 South Byrkit St., Mishawaka, Ind.
Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, Inc., 308 Piquette, Detroit 2.

Dust Collecting Equipment • Wet

Aerodyne Development Corp., 2424 Euclid Ave., Cleveland 15.
American Air Filter Co., Inc., 104 Central Ave., Louisville 8.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
Schmieg Industries, Inc., 308 Piquette, Detroit 2.
Claude B. Schneible Co., 2827-25th St., Detroit.
Whiting Corp., Harvey, Ill.

Electrodes

Great Lakes Carbon Corp., Niagara Falls, N. Y.
International Graphite & Electrode Corp., St. Marys, Pa.

Exothermic Materials (Pipe Eliminators)

Alpha-Lux Co., Inc., 155 John St., New York.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Exomet, Inc., Maple Ave., Conneaut, Ohio.
Exothermic Alloys Sales & Service, Inc., 301 E. 138th St., Chicago 27.
Foundry Services Inc., 280 Madison Ave., New York 16.
Lava Crucible Co. of Pittsburgh, 627 Wabash Bldg., Pittsburgh.
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17, N. Y.

Facings • Foundry

Asbury Graphite Mills, Inc., Asbury, N. J.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Minco Products Corp., Box 367, Saginaw, Mich.
S. Obermayer Co., 2563 West 18th St., Chicago 8.
Penn-Rillton Co., 324 W. 23rd, New York 11.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800-18th St., Detroit 16.
Stoller Chemical Co., 31 North Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
United States Graphite Co., 1621 Holland Ave., Saginaw, Mich.
Whitehead Brothers Co., 324 W. 23rd St., New York 11.

Ferro-Alloys

Climax Molybdenum Co., 500 Fifth Ave., New York.
Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17.
Exothermic Alloys Sales & Service, Inc., 301 E. 138th St., Chicago 27.
Globe Iron Co., Jackson, Ohio.
Jackson Iron & Steel Co., Jackson, Ohio.
Tennessee Products & Chemical Corp., American Nat'l Bank Bldg., Nashville.
Vanadium Corp. of America, 420 Lexington Ave., New York 17.

Fire Brick

Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Carborundum Co., Niagara Falls, N. Y.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
Pyro Refractories Co., Oak Hill, Ohio.
Robinson Clay Products Co., Box 1070, 65 W. State St., Akron 8, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Flask Lumber

Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
White Pine Lumber Co., 2460 S. Damen Ave., Chicago 8.

Flask Trimmings and Jackets

Adams Co., 100 East 4th St., Dubuque, Iowa.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Universal Engineering Co., Frankenmuth, Mich.

Flasks • Aluminum

Adams Co., 100 East 4th St., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
Hines Flask Co., 3431 W. 140th St., Cleveland 11.
Peerless Mineral Products Co., Whitney Block, Main St., Conneaut, Ohio.

Flasks • Magnesium

Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
Peerless Mineral Products Co., Whitney Block, Main St., Conneaut, Ohio.

Flasks • Steel

Black, Sivalls & Bryson, Inc., Power & Light Bldg., Kansas City, Mo.
Abe Cooper-Syracuse Inc., 107 W. Hiawatha Blvd., Syracuse, N. Y.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14.

Flasks • Wood

Adams Co., 100 East 4th St., Dubuque, Iowa.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.

Flexible Shaft Equipment

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.

Fluxes • Cupola

Carborundum Co., Niagara Falls, N. Y.
Cleveland Flux Co., 1026-34 Main Ave., N.W., Cleveland.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati.
Foundry Services Inc., 280 Madison Ave., New York 16.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Solvay Sales Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 746 W. Virginia St., Milwaukee 4.

Fluxes • Ladle

Cleveland Flux Co., 1026-34 Main Ave., N.W., Cleveland.
Foundry Services Inc., 280 Madison Ave., New York 16.
Solvay Sales Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.

Fluxes • Non-Ferrous

Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
Foundry Services Inc., 280 Madison Ave., New York 16.
Wm. F. Jobbins, Inc., Box 230, Aurora, Ill.
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17, N. Y.
Rossborough Supply Co., Box 2212—Brooklyn Station, Cleveland.

Fluxes • Welding

Linde Air Products Co., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.

Foundry Supplies • General

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Black Products Co., 13513 Calumet Ave., Chicago.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Rd., West Bromwich, England.
Foundry Service Co., 2321-2329—29th Ave. N., Birmingham, Ala.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Industrial Fabricating, Inc., 817 Hall, Eaton Rapids, Mich.
Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
North American Smelting Co., Marine Terminal, Wilmington 83, Dela.
S. Obermayer Co., 2563 W. 18th St., Chicago 8.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.

Furnace Linings

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Alpha-Lux Co., Inc., 155 John St., New York 1.
American Crucible Co., Washington Ave., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Joseph Dixon Crucible Co., 167 Wayne St., Jersey City 6, N. J.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Pyro Refractories Co., Oak Hill, Ohio.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.

Furnaces • Aluminum and Magnesium Melting

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Engineering Corp., Lalor and Hancock Sts., Trenton, N. J.
Ajax Metal Co., Frankford Ave. & Richmond St., Philadelphia.
Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Electric

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Engineering Corp., Lalor and Hancock Sts., Trenton, N. J.
Ajax Metal Co., 46 Richmond St., Philadelphia 23.
Detroit Electric Furnace Div., Kuhlman Electric Co., 1000—26th St., Bay City, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12.
Pittsburgh Lectromelt Furnace Corp., Box 1257, Foot of 32nd St., Pittsburgh.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Furnaces • Gas and Oil

Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Heat Treating

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Metal Co., 46 Richmond St., Philadelphia 23.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Goggles

Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh.
Pangborn Corp., Hagerstown, Md.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

Graphite Products

American Crucible Co., North Haven, Conn.
Asbury Graphite Mills, Inc., Asbury, N. J.
Joseph Dixon Crucible Co., 167 Wayne St., Jersey City 6, N. J.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
International Graphite & Electrode Corp., St. Marys, Pa.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
United States Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.
Vesuvius Crucible Co., Box 8275, Swissvale, Pittsburgh 18.

Grinders • Flexible Shaft

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.
PMS Co., 1071 Power Ave., Cleveland 14.

Grinders • Portable, Bench, and Stand

Cleco Div., Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Fox Grinders, Inc., 622 Oliver Bldg., Pittsburgh 22.
Rotor Tool Co., 17325 Euclid Ave., Cleveland.

Grinders • Swing Frame

DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Fox Grinders Inc., 622 Oliver Bldg., Pittsburgh.

Grinding Wheels

Bay State Abrasive Products Co., Union St., Westboro, Mass.
Carborundum Company, Niagara Falls, N. Y.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2.
Macklin Co., 2914 Wildwood Road, Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7.
Precision Grinding Wheel Co., Inc., 8301 Torresdale Ave., Philadelphia 36.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37.
United States Rubber Co., 1230 Avenue of the Americas, New York 20.

Hammers • Pneumatic

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dallett Company, Mascher at Lippincott St., Philadelphia.
Dayton Pneumatic Tool Co., P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.

Heaters • Ladle and Mold

Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Helmets • Blasting

Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh.
Pangborn Corp., Hagerstown, Md.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
United States Rubber Co., 1230 Avenue of the Americas, New York

Helmets • Welding

Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

Hoists • Chain or Electric

Cleveland Crane & Engineering Co., Cleveland Tramrail Div., Wickliffe, Ohio.

Hoists • Overhead

Cleveland Crane & Engineering Co., Cleveland Tramrail Div., Wickliffe, Ohio.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Hose • Oxygen and Acetylene

Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.
Manhattan Rubber Div., Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
United States Rubber Co., 1230 Avenue of the Americas, New York 20.

Hose • Pneumatic

Cleco Div., Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Dallett Co., Mascher at Lippincott St., Philadelphia 33.
Dayton Pneumatic Tool Co., 8-10 Norwood Ave., Dayton, Ohio.
Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.
Manhattan Rubber Div., Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
Master Pneumatic Tool Co., Inc., Peniman Road, Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.
United States Rubber Co., 1230 Avenue of the Americas, New York 20.

Ingots • Aluminum Alloy

Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
Federated Metals Division, American Smelting & Refining Co., Inc., 120 Broadway, New York 5.
Wm. F. Jobbins, Inc., Box 230, Aurora, Ill.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago.
Michigan Smelting & Refining Div., Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit 26.
Niagara Falls Smelting & Refining Division, Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17.
North American Smelting Co., Marine Terminal, Wilmington 83, Del.

Ingots • Non-Ferrous

Ajax Metal Co., 46 Richmond St., Philadelphia 23.
Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
L. A. Cohn & Bros., Inc., 5429 Roosevelt Rd., Chicago 50.
Federated Metals Division, American Smelting & Refining Co., Inc., 120 Broadway, New York 5.
Benj. Harris & Co., 11th & State Sts., Chicago Heights, Ill.
Wm. J. Jobbins, Inc., Box 230, Aurora, Ill.
H. Kramer & Co., 1345 W. 21st St., Chicago.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago.
Michigan Smelting & Refining Div., Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit 26.
Nassau Smelting & Refining Co., Inc., 1 Nassau Place, Tottenville, Staten Island, N. Y.
Niagara Falls Smelting & Refining Division, Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17.
North American Smelting Co., Marine Terminal, Wilmington 83, Del.
I. Schumann & Co., 4391 Bradley Rd., Cleveland.
Silverstein & Pinsof, Inc., 1720 Elston, Chicago.

Inspection and X-Ray

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14.
Magnaflux Corp., 5900 Northwest Highway, Chicago 31.

Insulation

Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22.
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.

Laboratory and Scientific Equipment

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Great Western Mfg. Co., 208-220 Choctaw St., Leavenworth, Kan.
K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Laboratory Equipment Corp., St. Joseph, Mich.
Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
Wheeleo Instruments Co., 847 W. Harrison St., Chicago 7.

Laboratory Service

Accurate Metal Laboratories, 2454 W. 38th St., Chicago 32.
Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Casadonte Research Laboratories, 2410 Lake Ave., North Muskegon, Mich.
Chicago Spectro Service Lab., Inc., 2454 W. 38th St., Chicago 32.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Charles C. Kawin Co., 431 S. Dearborn St., Chicago 5.
Andrew King, 521 Broad Acres Rd., Narberth, Pa.
Earl E. Woodliff, 14611 Fenkel, Detroit 27.

Ladle Linings • Fitted

American Crucible Co., North Haven, Conn.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
Joseph Dixon Crucible Co., 167 Wayne St., Jersey City 6, N. J.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22.
Pyro Refractories Co., Oak Hill, Ohio.

Ladle Linings • Plastic

Alpha-Lux Co., Inc., 155 John St., New York.
American Crucible Co., North Haven, Conn.
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
Pyro Refractories Co., Oak Hill, Ohio.
The Robinson Clay Products Co., Box 1070, 65 W. State St., Akron 8, Ohio.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.

Ladles

Industrial Equipment Co., 115 N. Ohio, Minster, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Magnetic Separators

Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Newaygo Engineering Co., Newaygo, Mich.

Magnets

Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland 4.

Matchplates

Accurate Match Plate Co., 1847-51 W. Carroll Ave., Chicago 12.
Precision Pattern Works, 5269 W. Grand Ave., Chicago 39.
Pressure Match Plate Co., Inc., 1013-15 N. Front St., Philadelphia 23.
Reliable Castings Corp., 3530 Spring Grove Ave., Cincinnati 23.
Scientific Cast Products Corp., 1390 E. 40th St., Cleveland.

Metallizing Equipment

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Metallizing Company of America, 3520 W. Carroll Ave., Chicago 24.

Metallographic Equipment

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.

Metal Marking Crayons

Wm. Korn, Inc., 260 West St., New York 13.

Meters • Air Velocity

Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago.

Milling Cutters and Burrs

Severance Tool Ind., Inc., Saginaw, Mich.

Mold Blowers

International Molding Machine Co., 1201 N. 12th Ave., La Grange Park, Ill.

Mold Conveyors

C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Chain Belt Co., 1725 W. Bruce Street, Milwaukee 4.
Link-Belt Company, 300 W. Pershing Road, Chicago 1.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Newaygo Engineering Co., Newaygo, Mich.

Mold Ovens and Dryers

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.

Molding Machines

Adams Co., 100 East 4th St., Dubuque, Iowa.
Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
British Moulding Machine Co. Ltd., Weston Works, Faversham, Kent, England.
Centrifugal Casting Machine Co., Box 947, Tulsa 1, Okla.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Crescent Machine Div., Rockwell Mfg. Co., Leetonia, Ohio.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Johnston & Jennings Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Wm. H. Nicholls Co., Inc., 126 St. & 91st Ave., Richmond Hill, N. Y.
Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
SPO Incorporated, 7500 Grand Division Ave., Cleveland.
Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.
Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35.

Monorail and Tramrail Systems

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Oils • Lubricating

Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33.
Penola, Inc., 221 N. LaSalle St., Chicago 1.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Swan Finch Oil Corp., RCA Bldg. West, New York 20.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Pa.

Ovens • Annealing and Heat Treating

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Salem Engineering Co., 714 S. Broadway, Salem, Ohio.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Oxygen

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Linde Air Products Co., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17.

Patterns

City Pattern Foundry & Machine Co., 1161 Harper at Rivard, Detroit.
Precision Pattern Works, 5269 W. Grand Ave., Chicago.
Reliable Castings Corp., 3530 Spring Grove Ave., Cincinnati 23.

Pattern Coatings and Finishes

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
PMS Co., 1071 Power Ave., Cleveland 14.

Pattern Compound

PMS Co., 1071 Power Ave., Cleveland 14.
Tamms Silica Co., 228 No. La Salle St., Chicago.

Pattern Lumber

Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
White Pine Lumber Co., 2460 S. Damen Ave., Chicago 8.

Pattern Plates

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7.
Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.
Foundry Service Co., 2321-2329—29th Ave. N., Birmingham, Ala.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
PMS Co., 1071 Power Ave., Cleveland 14.
Scientific Cast Products Corp., 1388-1392 E. 40th St., Cleveland 3.

Pattern Shop Equipment and Supplies

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7.
Crescent Machine Div., Rockwell Mfg. Co., Leetonia, Ohio.
Eastern Clay Products, Inc., Jackson, Ohio.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
PMS Co., 1071 Power Ave., Cleveland 14.

Photographic Materials • Metallography

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.
Eastman Kodak Co., 343 State St., Rochester, N. Y.

Pig Iron

Globe Iron Co., Jackson, Ohio.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Jackson Iron & Steel Co., Jackson, Ohio.
Tennessee Products & Chemical Corporation, American National Bank Bldg., Nashville.

Pig Iron • Alloy

Globe Iron Co., Jackson, Ohio.
Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro-Metals Co., 429 South 4th St., Keokuk, Iowa.

Plaster

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Tamms Industries Co., 228 N. La Salle St., Chicago.
United States Gypsum Co., 300 W. Adams St., Chicago.

Pneumatic Tools

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dallett Co., Mascher at Lippincott St., Philadelphia.
Master Pneumatic Tool Co., Inc., Orwell, O.
Schramm Inc., West Chester, Pa.

Porosity Equipment and Sealers

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Metallizing Company of America, 3520 W. Carroll Ave., Chicago 24.
Tincher Products Co., 800 Borden Ave., Sycamore, Ill.
Tousey Varnish Co., 520 W. 25th St., Chicago 16.

Portable Tools • Air

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dallett Co., Mascher at Lippincott St., Philadelphia 33.
Dayton Pneumatic Tool Co., 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.

Portable Tools • Electric

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.

Power Units and Transmissions

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
Ready-Power Co., 3826 Grand River Ave., Detroit 8.

Pyrometers • Immersion

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foxboro Co., Neponset Ave., Foxboro, Mass.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.
Tamms Industries Co., 228 N. La Salle St., Chicago.

Pyrometers • Optical

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.

Rammers • Pneumatic

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dayton Pneumatic Tool Co., P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.

Refractories

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
American Crucible Co., North Haven, Conn.
Carborundum Company, Niagara Falls, N. Y.
Carpenter Bros., Inc., 606 W. Wisconsin Ave., Milwaukee 3.
Cleveland Quarries Co., 1740 E. Twelfth St., Cleveland 14.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Jos. Dixon Crucible Co., Jersey City 3.
Eastern Clay Products, Inc., Jackson, Ohio
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.

Laboratory Equipment Corp., St. Joseph, Mich.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Philadelphia.
Pyro Refractories Co., Oak Hill, Ohio.
Quigley Company, Inc., 527 Fifth Ave., New York 17.
Robinson Clay Products Co., Box 1070, 65 W. State St., Akron 8, Ohio.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35.
Frederic B. Stevens, Inc., 1800-18th St., Detroit 16.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.
Vesuvius Crucible Co., Box 8275, Swissvale, Pittsburgh 18.

Respirators

Martindale Electric Co., 1347 Hird Ave., Cleveland 7.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8.
Pangborn Corp., Hagerstown, Md.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

Riddles and Screens

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Great Western Mfg. Co., 208-220 Choctaw St., Leavenworth, Kan.
Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.

Safety Clothing and Equipment

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8.
Pangborn Corp., Hagerstown, Md.
Reece Wooden Sole Shoe Co., 2207-11th St., Columbus, Neb.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
Safety First Shoe Co., Water St., Holliston, Mass.

Sand • Blast

Carborundum Co., Niagara Falls, N. Y.
Carpenter Bros., Inc., 606 W. Wisconsin Ave., Milwaukee 3.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47.
Industrial Minerals Co., Kirn Bldg., Lancaster, Ohio.
Manley Sand Co., Rockton, Ill.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.
Pangborn Corp., Hagerstown, Md.
Peerless Mineral Products Co., Whitney Block, Main St., Conneaut, Ohio.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh 1.
Steel Shot and Grit, Inc., Boston, Mass.
Tamms Industries, Inc., 228 N. La Salle St., Chicago 1.
Whitehead Brothers Co., 324 W. 23rd St., New York 11.

Sand • Core and Mold

Ayers Mineral Co., Masonic Temple, Zanesville, Ohio.
Carpenter Brothers, Inc., 606 West Wisconsin Ave., Milwaukee 3.
Central Silica Co., Zanesville, Ohio.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Hougland & Hardy—Hardy Sand Co., 507 S. E. 2nd St., Evansville, Ind.
Industrial Minerals Co., Kirn Bldg., Lancaster, Ohio.
Manley Sand Co., Rockton, Ill.
Millwood Sand Co., Masonic Temple, Zanesville, Ohio.
Minco Products Corp., Box 367, Saginaw, Mich.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Sand Products Corp., 609 Perry Payne Bldg., Cleveland 13.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Taggart Brimfield Co., 110 Bellevue Ave., Hammonton, N. J.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
Whitehead Brothers Co., 324 W. 23rd St., New York 11.
Zanesville Sand Co., Zanesville, Ohio.

Sand Blast Equipment

Alloy Metal Abrasive Co., 311 West Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Corp., 630 South Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47.
Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Pangborn Corporation, Hagerstown, Md.

Sand Control and Testing Equipment

Alpha-Lux Co., Inc., 155 John St., New York.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago.
Great Western Mfg. Co., 208-220 Choctaw, Leavenworth, Kan.
Laboratory Equipment Corp., St. Joseph, Mich.

Sand Handling and Conditioning Equipment

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Chain Belt Co., 1725 West Bruce St., Milwaukee 4.
Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.
Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
Moulders' Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Newaygo Engineering Co., Newaygo, Mich.
Nichols Engineering & Research Corp., 70 Pine St., New York 5.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

Sand Mixers

American Wheelabrator & Equipment Corp., 630 S. Byrkit St., Mishawaka, Ind.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Blystone Div., Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6.
Clearfield Machine Co., Box 249, Clearfield, Pa.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Moulders' Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.

Sand Reclamation Equipment

C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Nichols Engineering & Research Corp., 70 Pine St., New York 5.
Simplicity Engineering Co., Durand, Mich.

Saws • Metal Cutting

Carborundum Co., Niagara Falls, N. Y.
Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
PMS Co., 1071 Power Ave., Cleveland 14.

Saws • Woodworking

Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
PMS Co., 1071 Power Ave., Cleveland 14.

Scales

Toledo Scale Co., Telegraph Rd., Toledo 1, Ohio.

Shake-out Machinery

Allis-Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
Robins Conveyors Div., Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

Shock Absorption Materials

Raybestos-Manhattan, Inc., 61 Willett, Passaic, N. J.

Shot and Grit

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
Carborundum Co., Niagara Falls, N. Y.
Carpenter Brothers, Inc., 606 West Wisconsin Ave., Milwaukee 3.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati 33.
Foundry Service Co., 2321-2329—29th Ave. N., Birmingham, Ala.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Manley Sand Co., Rockton, Ill.
Pangborn Corp., Hagerstown, Md.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh.
Steel Shot & Grit Co., Inc., 39 Warren Bridge, Boston 14.
Whitehead Bros. Co., 324 W. 23rd St., New York 11.

Spectographic Equipment

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.

Temperature Control and Recording Devices

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foxboro Co., Neponset Ave., Foxboro, Mass.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.

Testing Equipment • Hardness

Andrew King, 521 Broad Acres Rd., Narberth, Pa.

Thermocouples

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foxboro Co., Neponset Ave., Foxboro, Mass.

Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Illinois Testing Laboratories, Inc., 420 N. La-Salle St., Chicago.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.
Tamms Industries, Inc., 228 N. La Salle St., Chicago 1.

Tumbling Barrels

Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Vacuum Cleaning Equipment

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.
Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.
Spencer Turbine Co., 486 New Park Ave., Hartford 6, Conn.
U. S. Hoffman Machinery Corp., 99 Fourth Ave., New York 3.

Ventilating Systems

Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
Pangborn Corp., Hagerstown, Md.
H. H. Robertson Co., 2400 Farmers Bank Bldg., Pittsburgh 22.
Schmieg Industries, Inc., 308 Piquette, Detroit 2.
Claude B. Schneible Co., 2827-25th St., Detroit.

Vibrators

Adams Co., Box 268, Dubuque, Iowa.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee.
Dallett Co., Mascher at Lippincott St., Philadelphia.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
Syntron Co., 545 Lexington, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35.

Welding and Cutting Equipment

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Delta-Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Linde Air Products Co., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.
Metallizing Co. of America, 3520 W. Carroll Ave., Chicago 24.

Welding Rods

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Haynes Stellite Div., Union Carbide & Carbon Corp., Kokomo, Ind.
International Nickel Co., Inc., 67 Wall St., New York 5.
Linde Air Products Co., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.
National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York.

Wheelbarrows

Kwik-Mix Co., c/o Koehring Co., 3026 W. Concordia, Milwaukee 16.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14.

Woodworking Machinery

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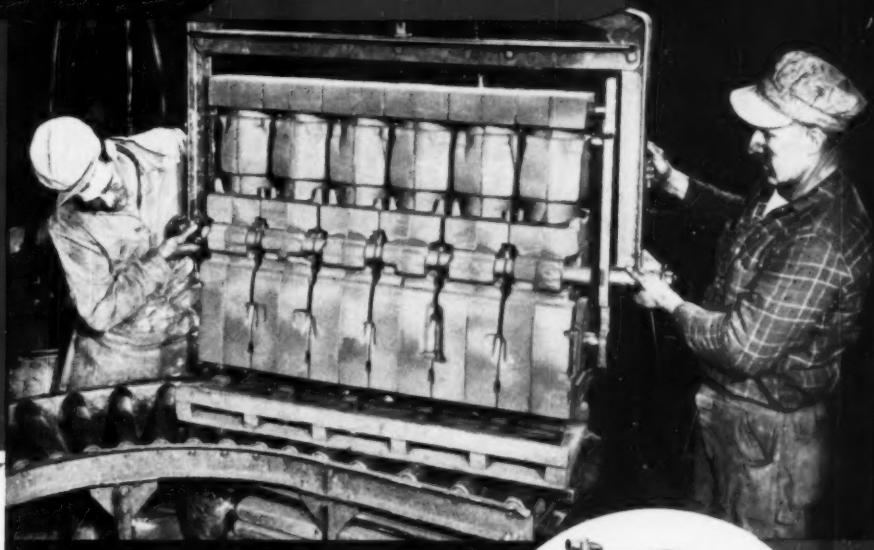

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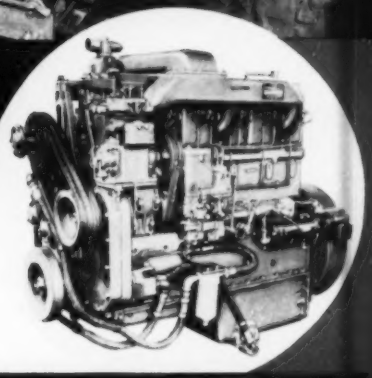

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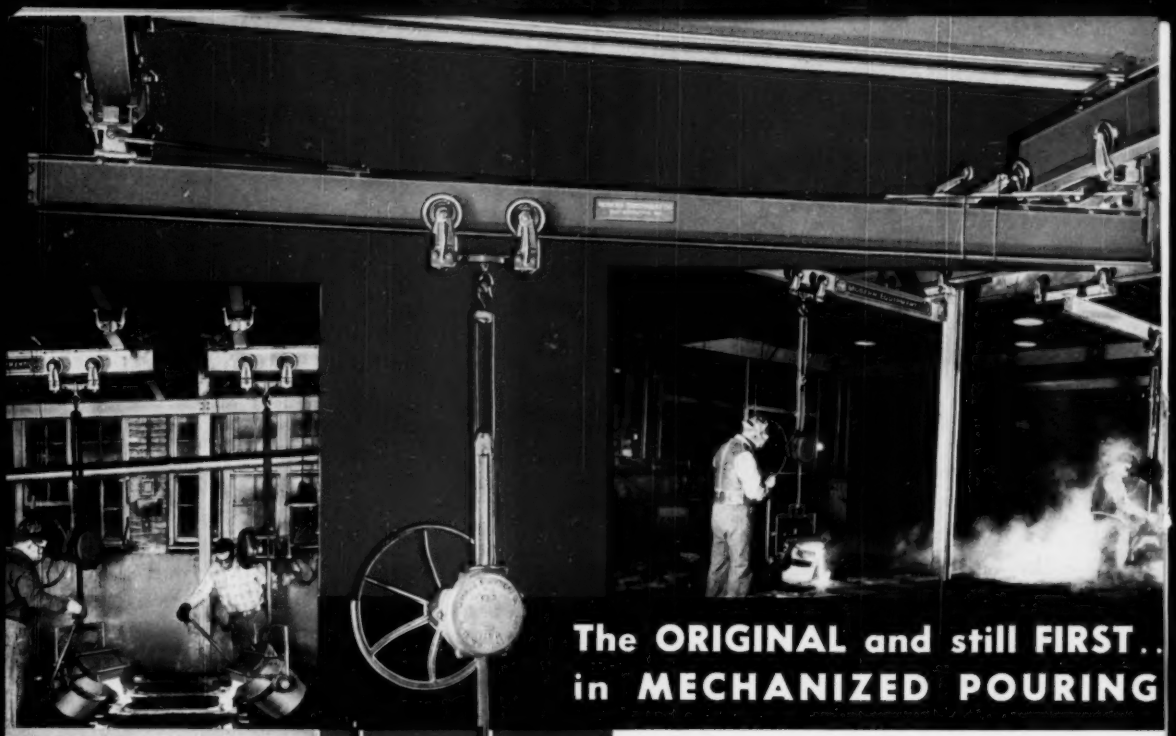

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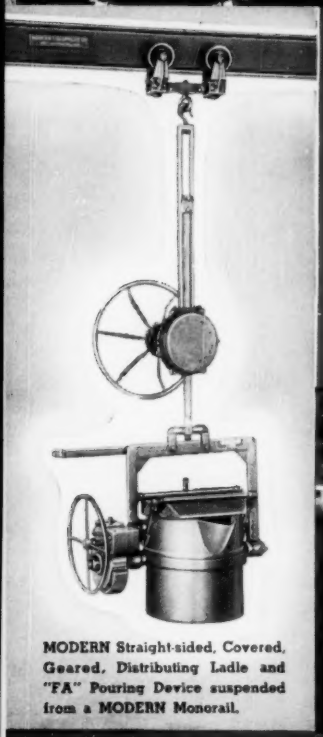

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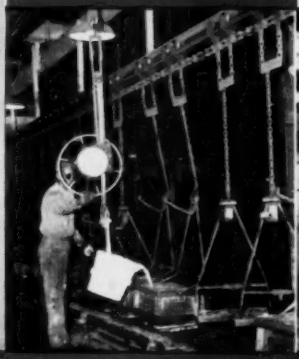

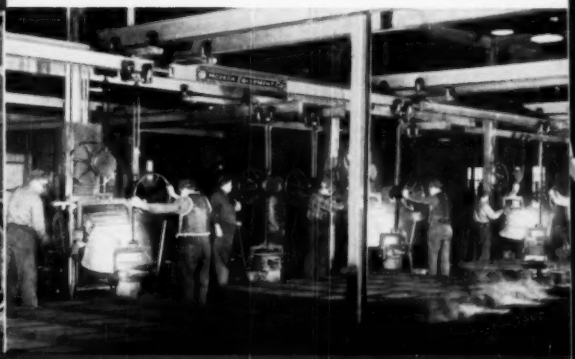

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